

STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)



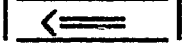


A02 = How to use the microcard		1	2	3		4
				SIS		
A01 = Structure of microcard	-A-	-***X*	X*XXX	XXXXX	XXXXX	*XXXX X
B01 = Trouble-shooting chart	-B-	-*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	F-	XXXXX	XXXXX	XXXXX	XXX	
	G-	XXXXX	XXXXX	XXXX		
	H-					
	J-					
	K-					
	L-					
	M-					
N01 = Service Information	-N-	-*XXXX	XXXXX	XXXXX	XXX	XX XX*
		12345	67890	12345	67890	12345 678
			1		2	

- Index
- N28 = Table of contents and publication information
- 1 = Special features
  - 2 = Safety and precautionary measures
  - 3 = Test equipment and tools
  - 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

			
Beginning	Mid-section	End	One-page section
A01			

HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system:

Electronic ignition (EI)

Descriptions, photos, terminal designations and special features refer to the vehicle:

OPEL Omega-A  
with 1.8 l / 4-cylinder engine 9.86 ->  
18 NV - Engine (carburetor)  
18 SV - Engine (carburetor)  
18 SEH- Engine (LE-Jetronic)

These basic instructions are detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions.  
Caution! Descriptions and photos may differ from the vehicle-specific brief instructions.

Binding set values, terminal designations and special features should be taken from the vehicle-specific brief instructions only.  
For brief instructions see table-of-contents microcard KFZ-00..

A02		
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SPECIAL FEATURES

Octane-number adjustment

Through the use of an encoding plug it is possible to make an adjustment to different grades of fuel. See top picture, arrow.

A specific map in the EI control unit is selected, depending on the design of the encoding plug (resistance value).

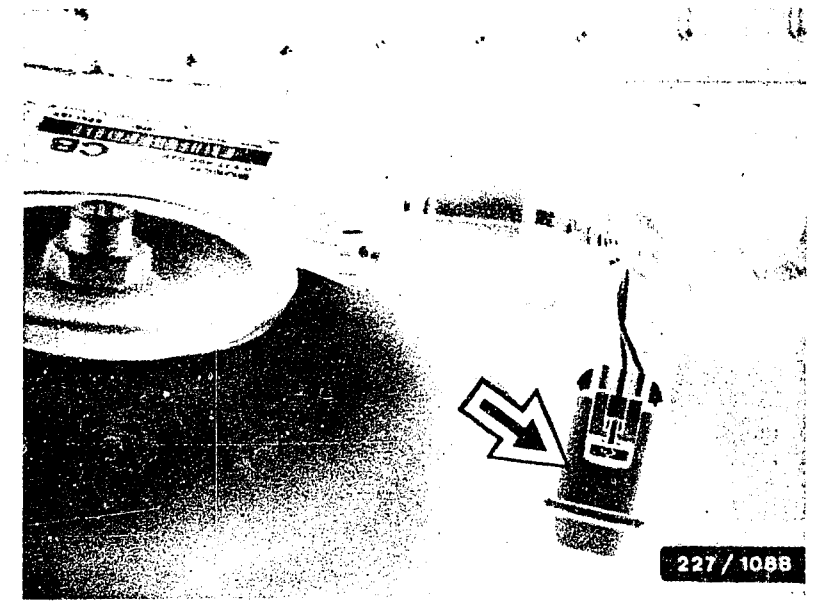
This new map then permits operation with a specific grade of fuel, e.g. premium leaded 98 RON, premium unleaded 95 RON, or premium unleaded 95 RON, regular unleaded 91 RON.

The encoding plug is identified on both sides with the respective octane number (RON). See bottom picture Item 1. The arrow on the closing bracket points to the set octane number. See bottom picture Item 2.

The factory coding has been set for maximum power, optimal driveability, lowest fuel consumption and lowest exhaust emissions.

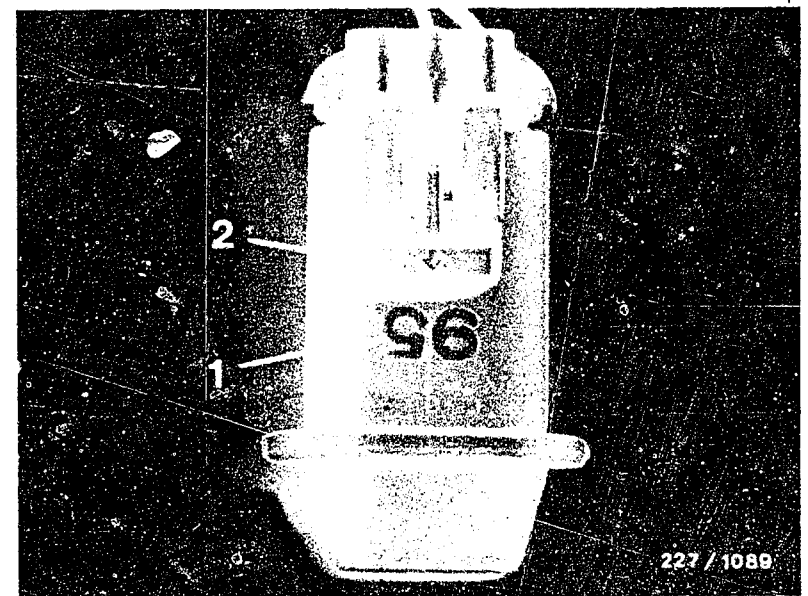
Only in exceptional cases should this setting be changed temporarily to a less favorable setting.

See the following table for encoding plug and fuel grades.



Arrow = Encoding plug

- 1 = Octane number
- 2 = Closing bracket with arrow

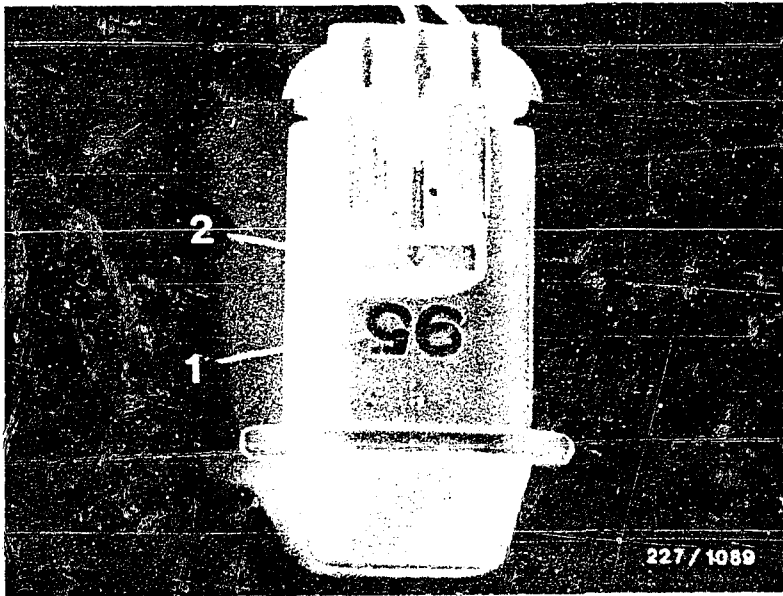


SPECIAL FEATURES (Continued)

Encoding plug and fuel grades				
Engine	18 NV	18 SV	18 SEH	Encoding plug - color
Premium leaded DIN 51600 98 RON		2)	3)	1)= black /yellow 2)= brown / green 3)= brown / white
Premium unleaded DIN 51607 95 RON				
Premium unleaded DIN 51607 95 RON	1)			
Regular unleaded DIN 51607 91 RON				

Procedure: For re-encoding, unlock the plug at the closing bracket, turn through 180° and lock again.

Note: Re-encoding may also be performed by the customer. The vehicle owner manuals contain appropriate instructions.



- 1 = Octane number
- 2 = Closing bracket with arrow

## SAFETY AND PRECAUTIONARY MEASURES

Danger of accident on semi-conductor ignition systems.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led sometime ago to manufacturers starting to equip their vehicles with semi-conductor ignition systems as original equipment.

In most cases, the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" components or terminals (whether on the primary side or the secondary side) can prove fatal. In this connection, we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

## SAFETY AND PRECAUTIONARY MEASURES (continued)

The ignition system should always be switched off when working on the ignition system (switch off ignition or voltage source).

Such work includes:

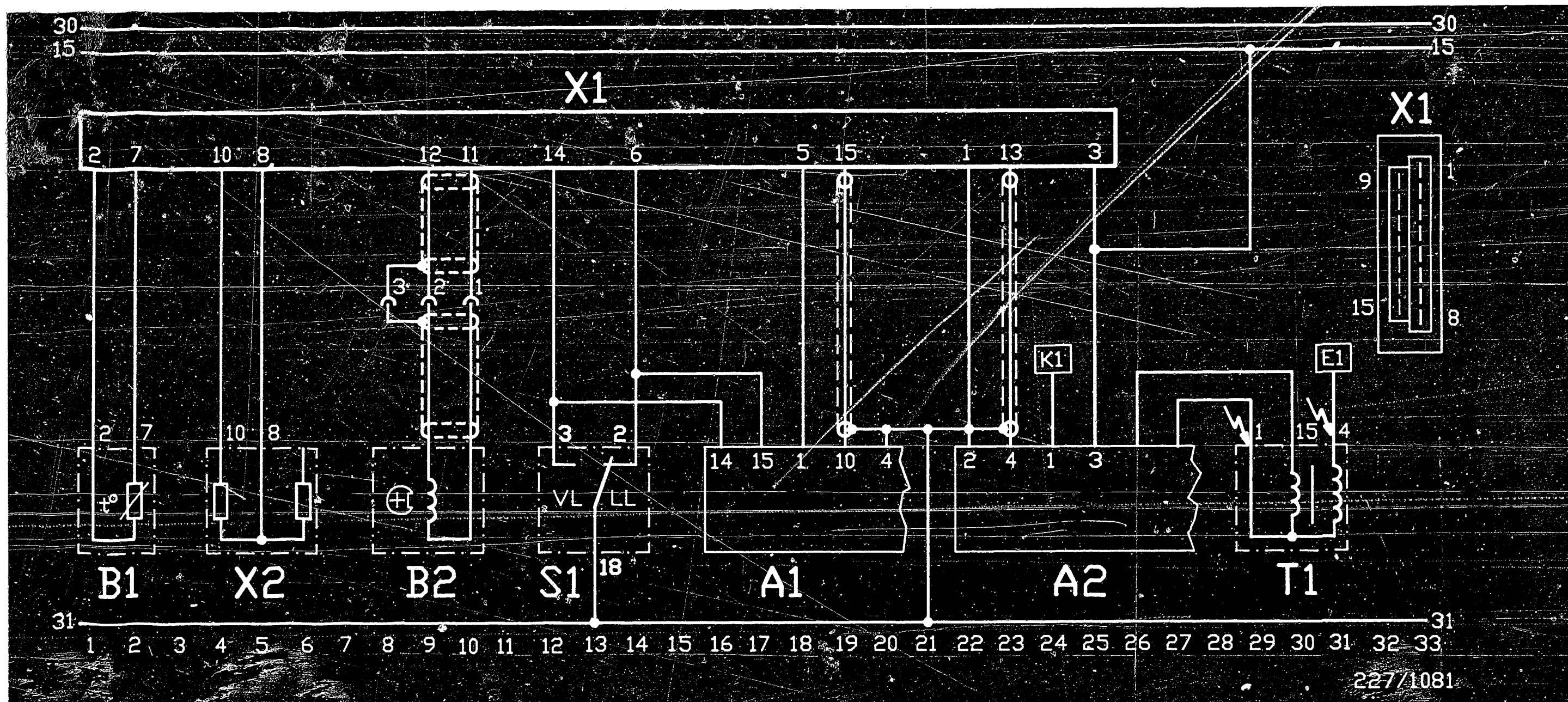
Connecting of engine test equipment (timing strobe, dwell-tach tester, ignition oscilloscope etc.).

Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, H.T. ignition cables etc.).

If, while testing the ignition system or during adjustment work on the engine (e.g. carburetor), it becomes necessary to switch on the ignition (switch on the ignition or voltage source), the above-mentioned dangerous voltages occur throughout the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e.g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





227/1081

# Danger arrows:

A1 = LE-Jetronic control unit  
A2 = Trigger box  
B1 = Engine temperature sensor  
B2 = Pulse generator

# Warning: 400 V $\sim$ , 25 kV

E1 = to high-voltage distributor  
K1 = to engine-speed relay  
S1 = Throttle-valve switch  
T1 = Ignition coil

X1 = EI control-unit plug  
X2 = Encoding plug (octane-number adjustment)

# SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

The dangerous locations are identified by danger arrows with reference to the example of the terminal diagram of an electronic ignition system.

## SAFETY AND PRECAUTIONARY MEASURES (continued)

During the compression test, either pull off the trigger-box plug or firmly connect terminal 4 of the ignition coil to ground using an extra cable (dangerous voltages, insulation damage at ignition coil, ignition distributor, ignition harness).

### Note:

The extra cable must be suppressed with at least 2 k  $\Omega$ , e.g. with sleeve-type suppressor (5 k  $\Omega$ ) 0 356 500 001.

Never start the engine without the battery securely connected (battery terminals tightened). Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine. Provide starting assistance only with a second 12 V battery and jump leads.

Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or when providing starting assistance, follow the operating instructions for the fast charger as well as the instructions of the vehicle manufacturer.

Disconnect the battery from the vehicle electrical system before charging or fast-charging.

## SAFETY AND PRECAUTIONARY MEASURES (Continued)

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery, may lead to the destruction of trigger box and ignition coil as well as control unit.

Do not connect or disconnect wiring-harness plugs from control unit or trigger box with the ignition on.

Remove control units at temperatures above +80 °C (paint-drying installation).

Remove control units before performing electric welding work.

Do not replace the specified ignition coil (see part no.) with a different ignition coil.

No suppression capacitor may be connected to ignition coil term. 1.

Never connect the positive pole of the battery to ignition coil term. 1. Trigger box will be destroyed.

Do not short-circuit ignition coil term. 1 to ground (e.g. in order to switch off the engine). Ignition coil and possibly trigger box will be destroyed.

## SAFETY AND PRECAUTIONARY MEASURES (Continued)

Ignition cable between ignition coil and high-voltage distributor term. 4 must not be disconnected during operation.

There must be no arcing between ignition coil term. 4 and ignition coil term. 1 and term. 15.

To prevent destruction of the trigger box, the secondary side of the ignition system must have at least 2 k  $\Omega$  interference suppression, and the original distributor rotor with 1 k  $\Omega$  must be installed.

Incorrect indication of engine speed, dwell angle and ignition point:

With this ignition system (trigger box with current limitation), there may be an incorrect indication of engine speed, dwell angle and ignition point on testers.

For further information, see Coordinates N10-N17

## TEST EQUIPMENT AND TOOLS

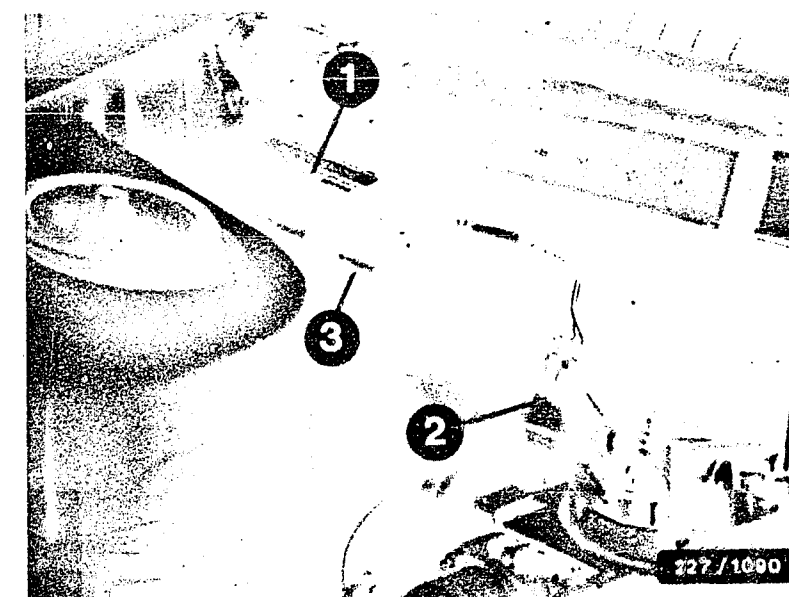
Motortester e.g. Mot 206	0 684 000 206
TDC pickup	1 687 224 633 .. 655
Sleeve-type suppressor 5 k $\Omega$	0 356 500 201
Ohmmeter ETE 014.00 or e.g. Pontavi Wh 2	0 684 101 400 Commercially available
Voltmeter e.g. ETE 014.00	0 684 101 400
Test leads (for correct connection of test equipment at connectors)	KDZS 0004 KDZS 0005
Test prod, black Test prod, red (for correct connection of test equipment at connectors)	1 684 485 034 1 684 485 035
Vacuum pump e.g. Mityvac from Korinth Ludwig-Kloss-Str.21 6450 Hanau 7-Steinheim	Commercially available
Connecting cable for ign. coil (for term. 1 green)	1 684 443 055
Connecting cable for ign. coil (for term. 15 yellow)	1 684 443 054

## INSTALLATION POSITION OF COMPONENTS

The EI control unit is in the engine compartment at the rear right. See top picture, Item 1

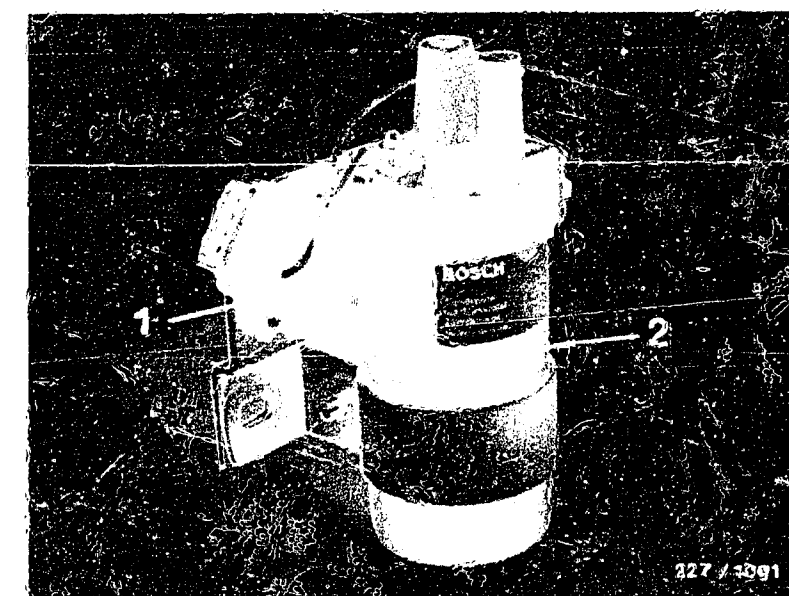
The encoding plug is on the wiring harness of the EI control-unit plug.  
See top picture, Item 2

Trigger box and ignition coil are mounted on a common heat sink and are located below the battery.  
See bottom picture.



- 1 = EI control unit
- 2 = Encoding plug
- 3 = Vacuum hose  
(for carburetor version)

- 1 = Trigger box
- 2 = Ignition coil

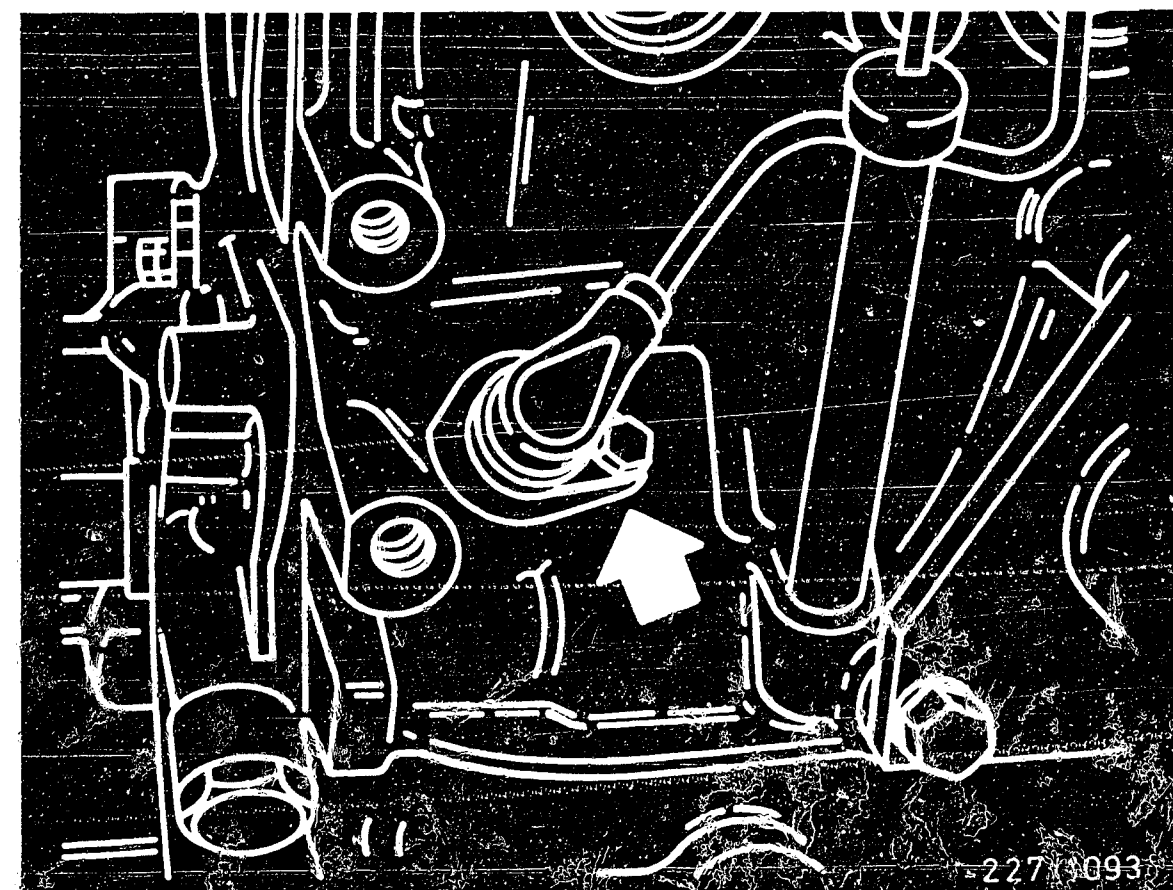




Arrow = Engine temperature sensor

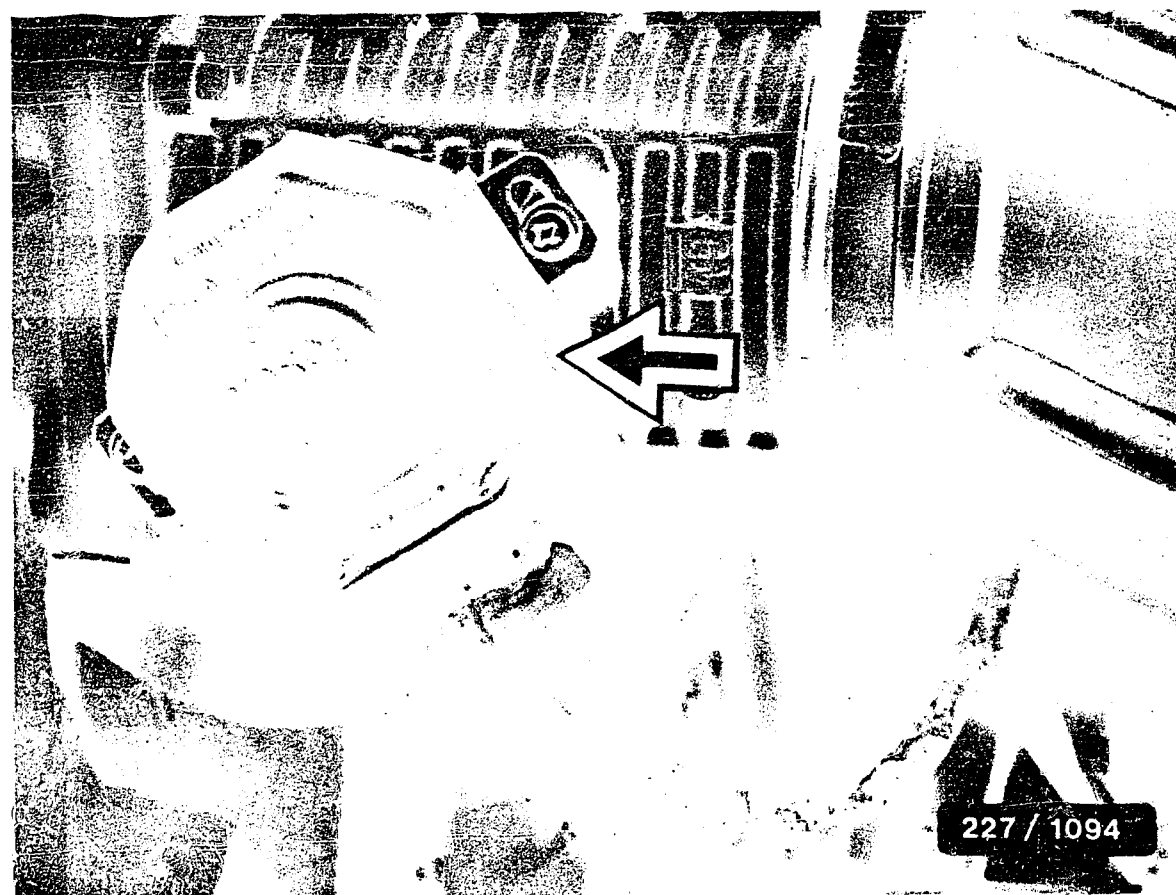
#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The engine temperature sensor is near the oil filter.



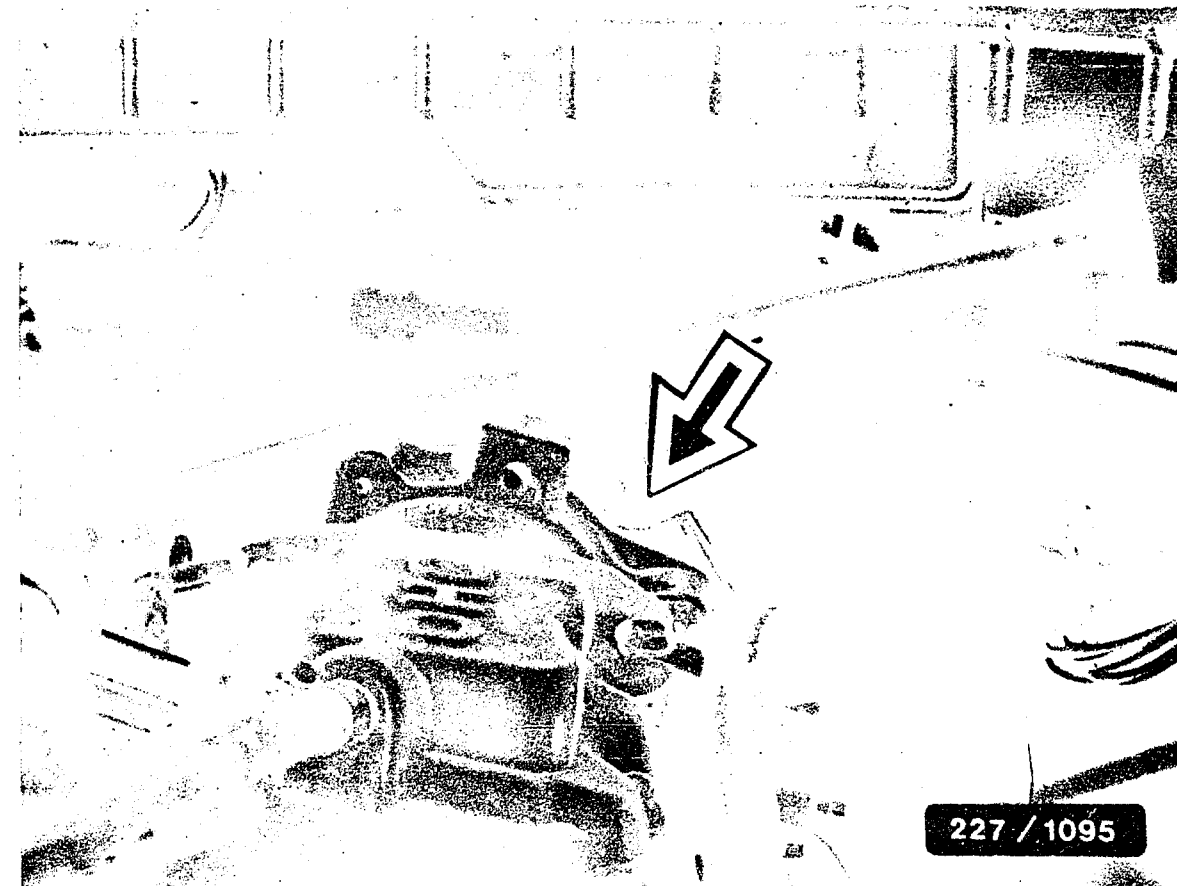
Arrow = Pulse generator

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)



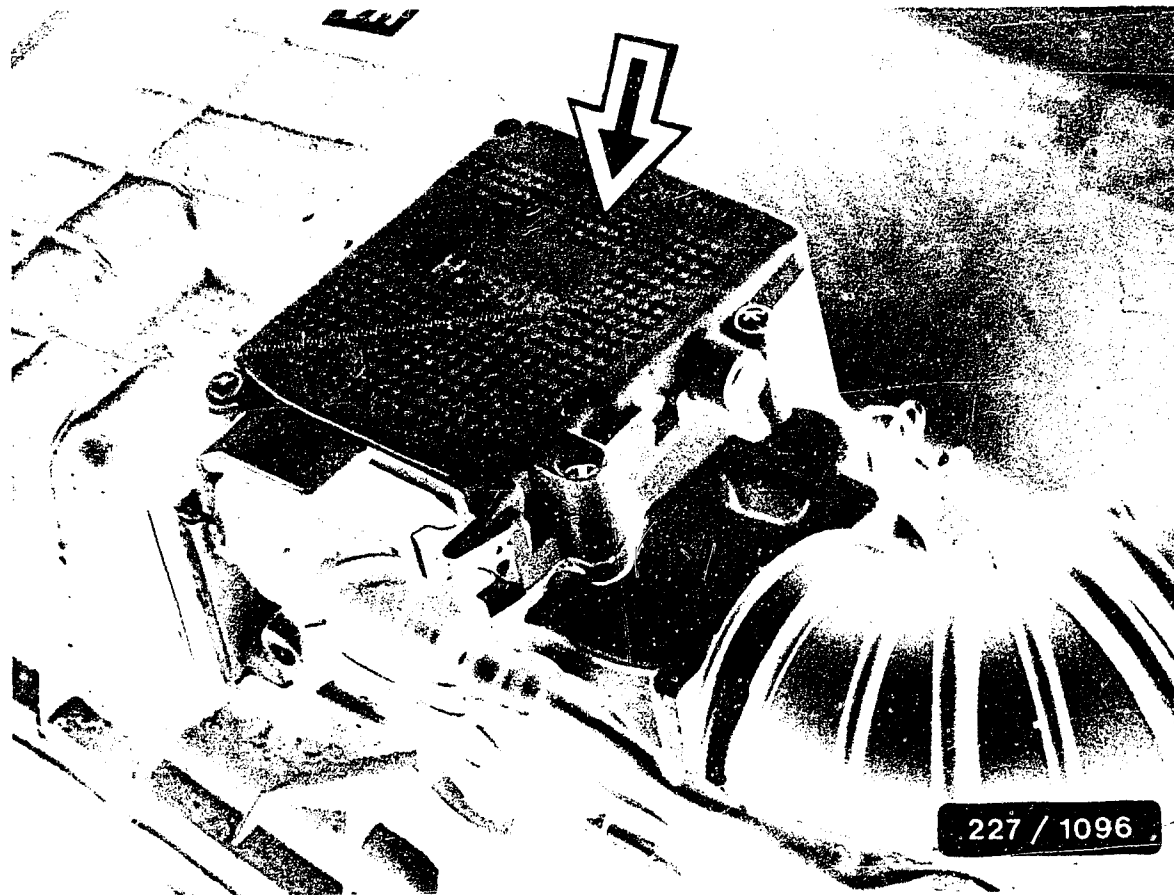
Arrow = Throttle-valve switch  
(for LE-Jetronic)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



Arrow = High-voltage distributor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



Arrow = LE-Jetronic control unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

For production reasons:  
continued on the following  
coordinate.



## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on coordinate B03 and contains customer complaints (fault symptoms) with several possible causes (component faults) in each case as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, this is a cause for which no test instructions are required.

If the customer complaint is clear, proceed with trouble-shooting in the given order of possible causes one after the other and step by step.

Always start trouble-shooting with the self-diagnosis (if applicable) or with the universal test adapter (if provided). Only then continue with the trouble-shooting chart.

If the customer complaint is not clear, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (owing to the interlinking of test steps).

If, after checking all the possible causes, the customer complaint has still not yet been rectified, then TRY installing a new specified coil or trigger box/control unit.

## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (continued)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains instructions on trouble-shooting and fault rectification.

The right-hand column contains the illustrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there. After rectifying a fault repeat the test as a check.

### REQUIREMENTS FOR TESTING:

- Battery fully charged
- Engine in good mechanical condition (e.g. compression, valve clearance etc.)
- Engine at operating temperature, approx. +80°C (where necessary)
- Proper seating of all plug connections of wiring harness



## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine knocking/pinging.
10. Engine overheating.
11. Fault lamp.

										Cause (component defect)	Coord.
*			*							High-tension side	B07
*										Firing sequence	—
*			*							Ignition coil	B09
*										Voltage to EI control unit	B11
*										Voltage to trigger box	B13
*										Pulse generator insulation	B15
*										Pulse generator internal resistance	B17

## TROUBLE-SHOOTING CHART (Continued)

## Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine knocking/pinging.
10. Engine overheating.
11. Fault lamp.

										Cause (component defect)	Coord.
*										Pulse generator voltage	B19
*										Operation of EI control unit	B21
*										Primary signal	B25
*										Contact resistance	B27
*										Engine-speed signal (LE-Jetronic)	C01
		*		*	*	*				Operation of pressure sensor (carburetor)	C03

TROUBLE-SHOOTING CHART (Continued)

Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine knocking/pinging.
- Engine overheating.
- Fault lamp.

Cause (component defect)										Coord.
	*		*	*		*				Pressure sensor leaking (carburetor) C05
	*	*	*	*						Idle throttle-valve switch (LE-Jetronic) C07
	*	*		*						Full-load throttle-valve switch (LE-Jetronic) C11
						*				Engine temperature sensor C13
	*		*			*				Load signal (LE-Jetronic) C15
		*								Ignition coil voltage C19
			*	*		*				Octane number adjustment C19

For production reasons:  
continued on the following  
coordinate.

TROUBLE-SHOOTING PROGRAM ( 1 )

V

Test high-voltage side.

N>

Repair high-voltage  
side.

Test operation of spark plugs,  
spark-plug connectors, inter-  
ference-suppression resistors,  
H.T. ignition leads, distributor  
cap, distributor rotor etc.  
(e.g. open circuit, shunt).

Assessment e.g. via ignition  
oscillogram, resistance measure-  
ment and visual check.

High-voltage side O.K.?

V

Return to trouble-shooting chart  
B03

B07

==>

B08

<==>

## TROUBLE-SHOOTING PROGRAM ( 2 )

Check ignition coil

Visual examination:

Remove protective cap from ignition coil and check whether plug is in position and whether sealing compound has escaped.  
See picture.

Electrical check:

Ignition coil primary term. 15  
and term. 1

(Take resistance of test lead  
and test prods into account)

Set value: see brief instructions

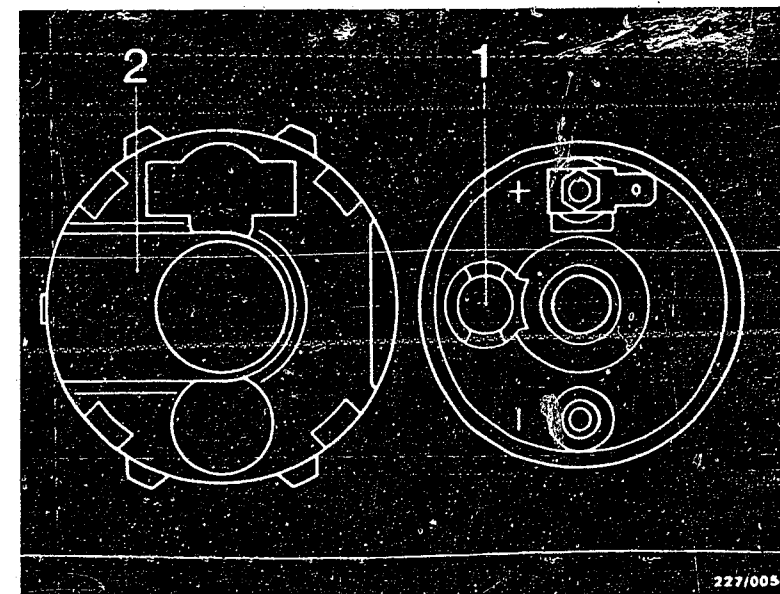
Ignition coil secondary term. 1  
and term. 4

Set value: see brief instructions

Visual examination O.K./set value  
obtained?

N>

1. If plug is not in position and/or sealing compound has escaped, replace EI control unit, trigger box and ignition coil.
2. If set values not O.K., replace ignition coil.



1 = Plug  
2 = Protective cap

Return to trouble-shooting chart  
B03

B09

<=>

B10

<=>

# TROUBLE-SHOOTING PROGRAM ( 3 )

Check voltage to EI control unit.

Disconnect EI control-unit plug and connect voltmeter to term. 3 (+) and term. 1 (-). See picture.

Switch on ignition.

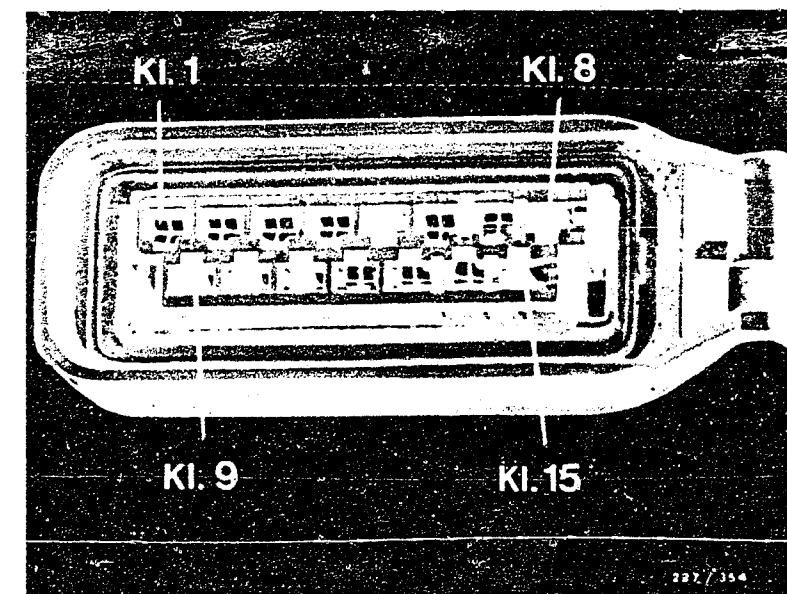
Set value: battery voltage

Set value obtained?

N>

Check for open circuit in leads and connections between ignition/starting switch and trigger-box plug term. 3 including ground lead term. 1.

Eliminate open circuit.



EI control-unit plug

Return to trouble-shooting chart B03

B11

<=>

B12

<=>

# TROUBLE-SHOOTING PROGRAM ( 4 )

Check voltage to trigger box.

Disconnect trigger-box plug  
and connect voltmeter to term. 3  
(+) and term. 2 (-).  
See picture.

Switch on ignition.

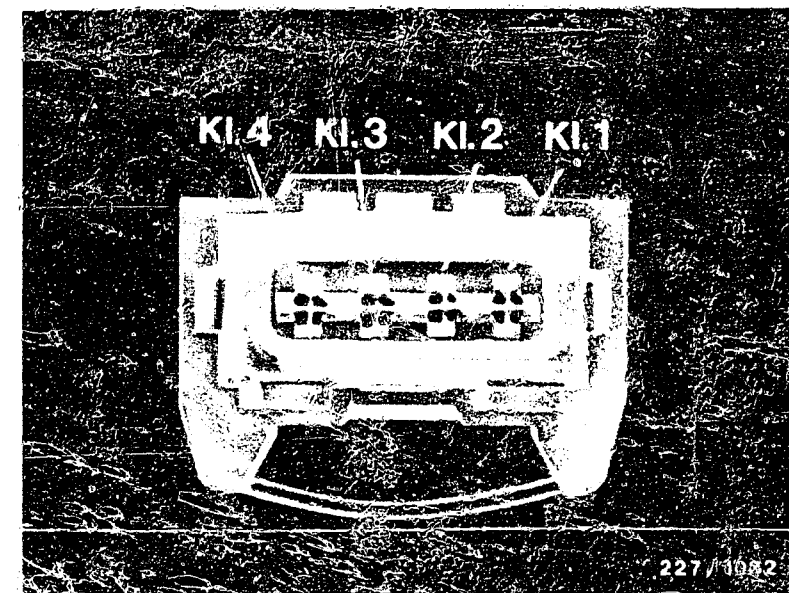
Set value: battery voltage

Set value obtained?

N>

Check for open circuit in leads  
and connections between ignition/  
starting switch and trigger-box  
plug term. 3 including ground  
lead term. 2.

Eliminate open circuit.



Trigger-box plug

Return to trouble-shooting chart  
B03

B13

<=>

B14

<=>

# TROUBLE-SHOOTING PROGRAM ( 5 )

Check insulation of pulse generator.

Disconnect EI control-unit  
plug and connect ohmmeter to  
term. 1 and term. 12.  
See top picture.

Set value: infinity  $\Omega$

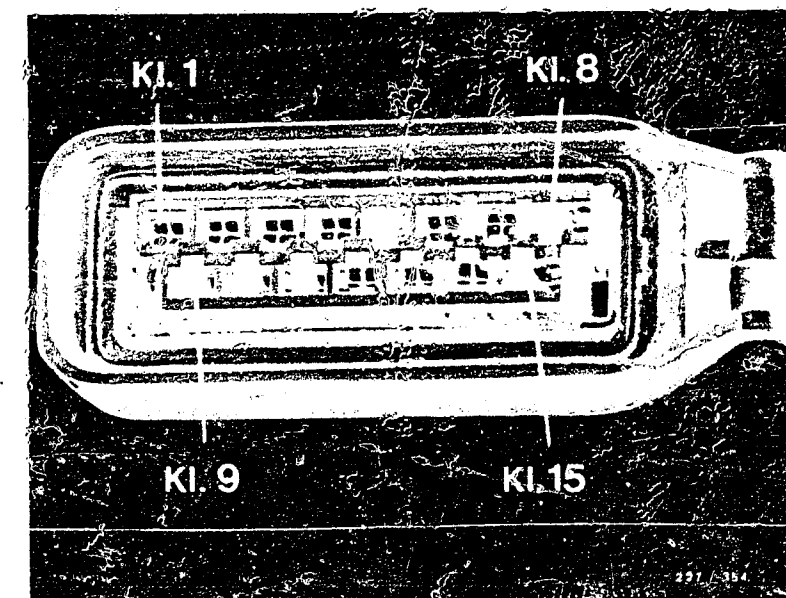
Set value obtained?

N>

Take apart plug connector of pulse  
generator.  
See bottom picture.

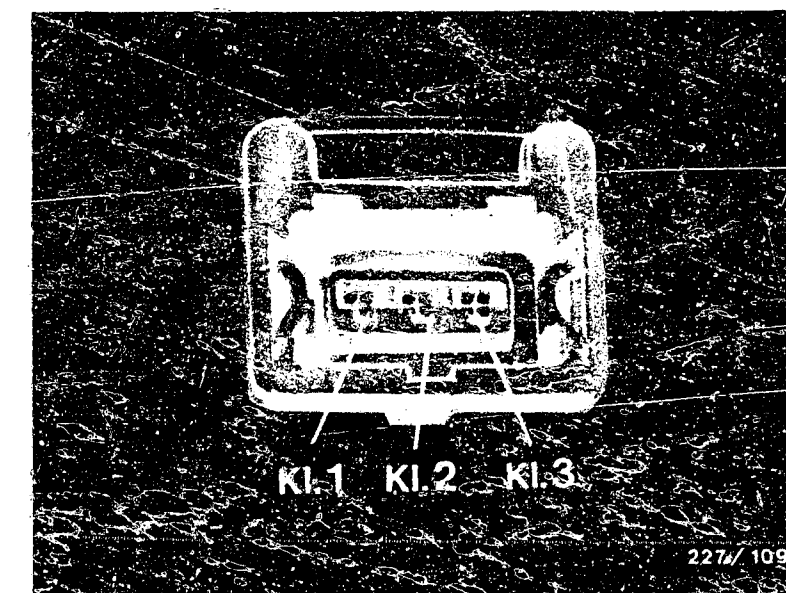
If set value now obtained,  
replace pulse generator.

If set value not obtained,  
eliminate short circuit to  
ground between plug connector  
and EI control-unit plug.



EI control-unit plug

Plug connector of pulse generator



Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM ( 6 )

Check internal resistance of pulse generator.

Disconnect EI control-unit plug and connect ohmmeter to term. 11 and term. 12.  
See top picture.

Set value: see brief instructions

Set value obtained?

N>

Take apart plug connector of pulse generator and check for damage and oxidation.  
See bottom picture.

Connect ohmmeter consecutively to:

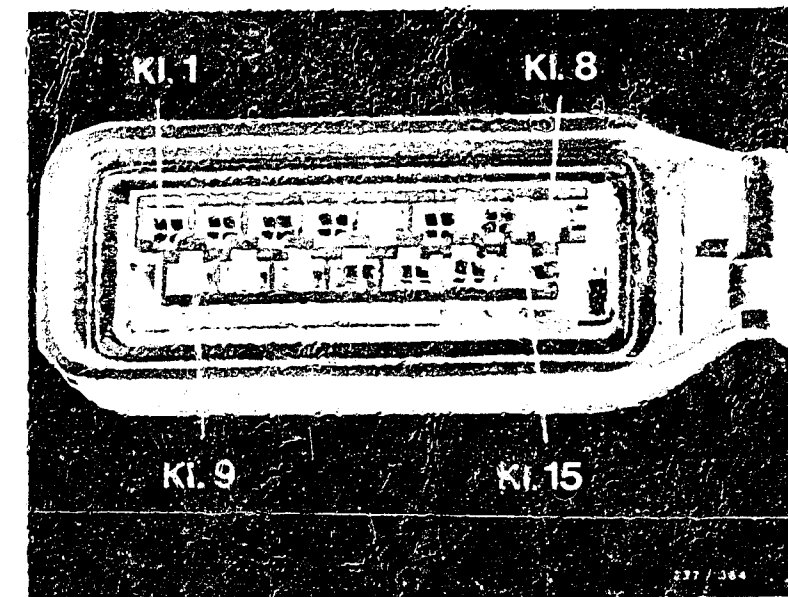
EI control-unit plug	Plug connector
----------------------	----------------

Term. 12	and	term. 2
Term. 11	and	term. 3
Term. 11	and	term. 1

Set value: approx. 0  $\Omega$  in each case (continuity)

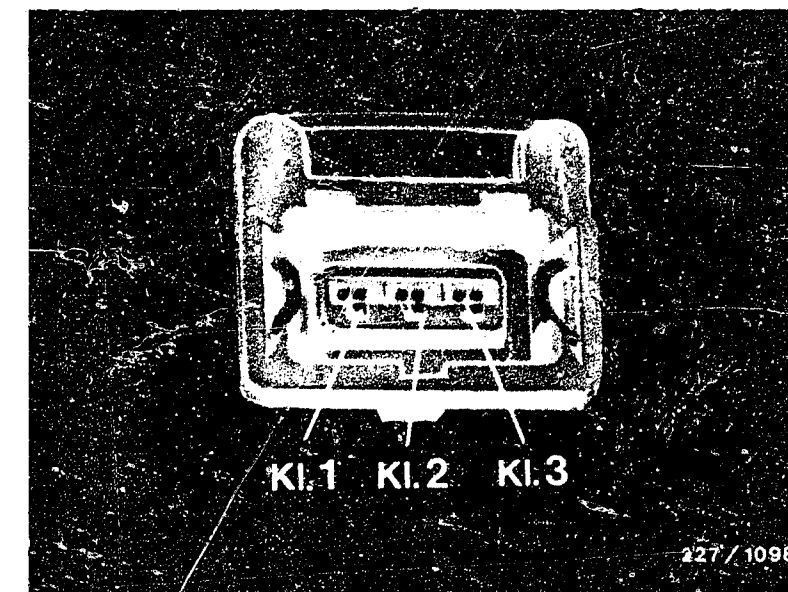
Eliminate open circuit.

If there was no open circuit, replace pulse generator.



EI control-unit plug

Plug connector of pulse generator



Return to trouble-shooting chart B03



# TROUBLE-SHOOTING PROGRAM ( 7 )

Check voltage to pulse generator.

Disconnect EI control-unit plug.

Connect oscilloscope according to operating instructions with program switch in "special" position.

For example MOT 201:

Connect red and black clamps to EI control-unit plug term. 12 (+) and term. 11(-). See top picture.

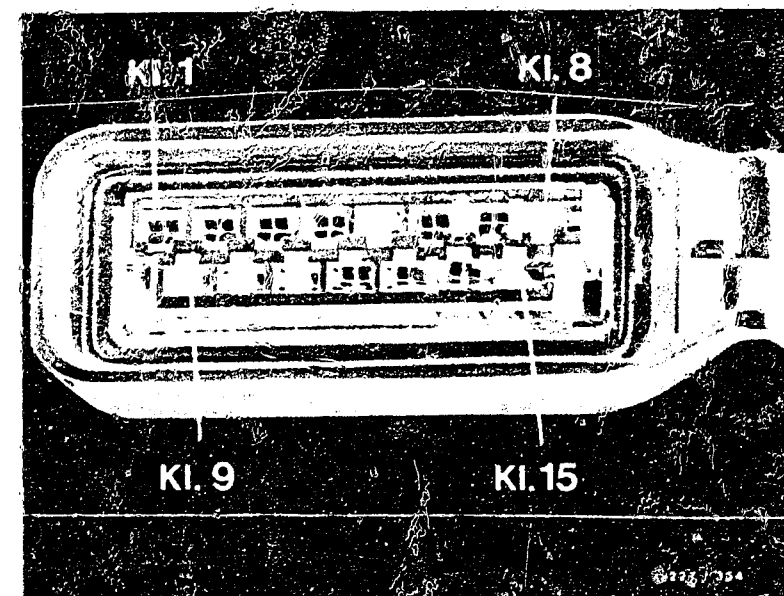
Start engine.  
Oscilloscope must indicate a voltage.

Set value: equal to/greater than 1,0 V

See bottom picture.

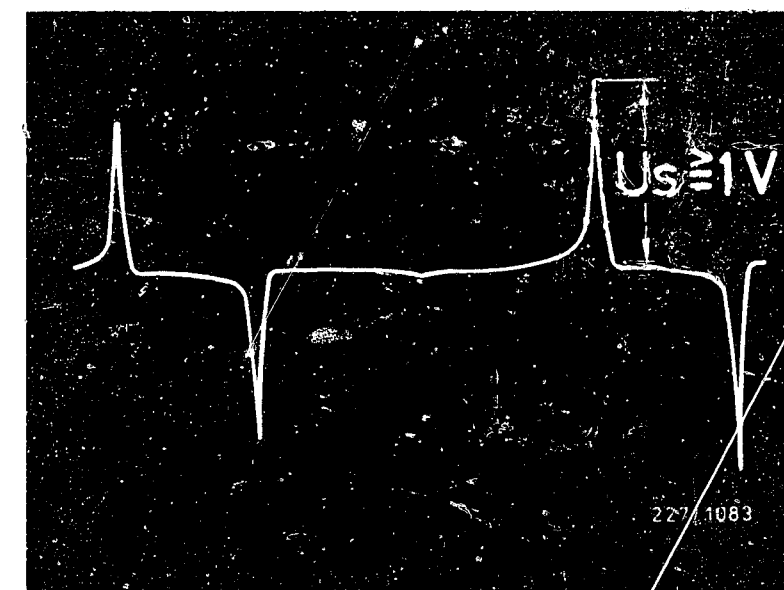
Set value obtained?

Replace pulse generator.



EI control-unit plug

Voltage to pulse generator



Return to trouble-shooting chart B03

B19

B20

# TROUBLE-SHOOTING PROGRAM ( 8 )

Check operation of EI control unit.

EI control-unit plug connected.  
Disconnect trigger-box plug.  
See top picture.

Connect oscilloscope according to operating instructions with program switch in "special" position.  
For example MOT 201:

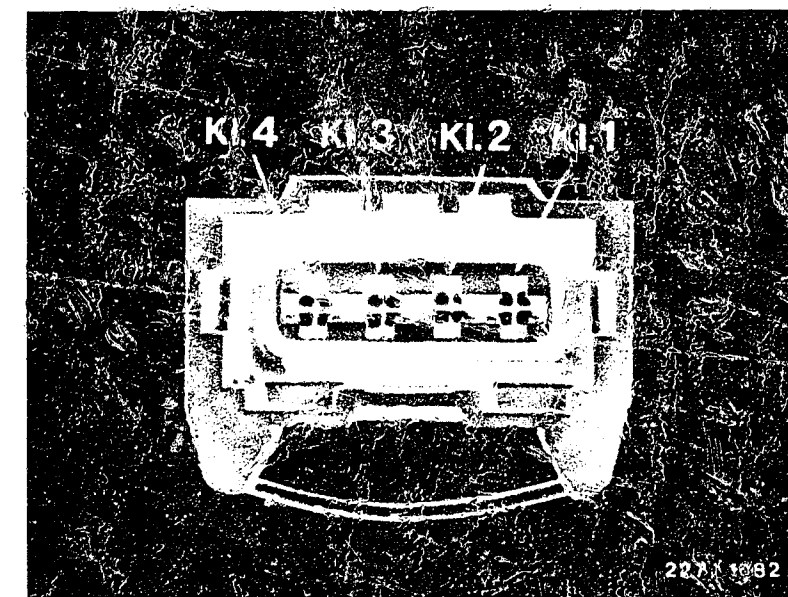
Connect red and black clamps to control-unit plug term. 4 (+) and term. 2 (-).

Start engine.

Oscilloscope must indicate a rectangular pulse.  
See bottom picture.

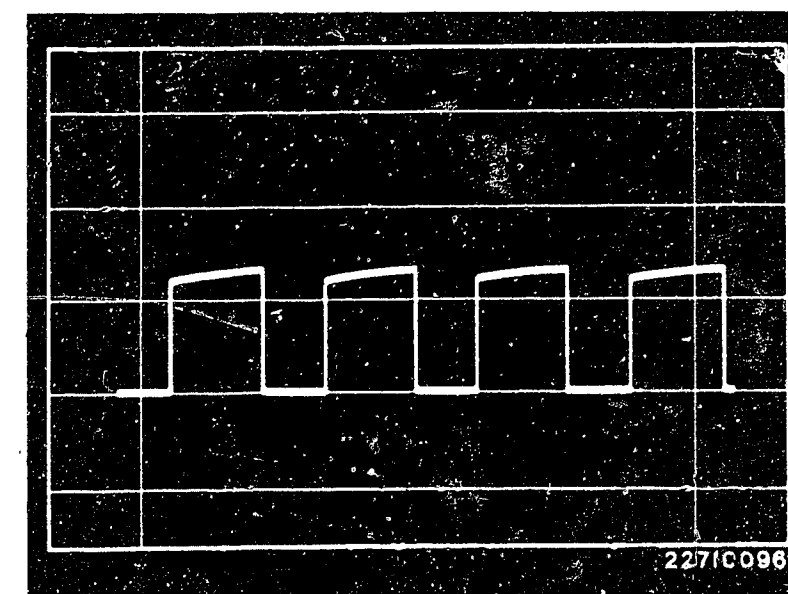
Rectangular pulse present?

Disconnect trigger-box and EI control-unit plugs.



Trigger-box plug

Rectangular pulse



Return to trouble-shooting chart B03

Continued on next picture page

Connect ohmmeter consecutively to:

Trigger-box plug	Trigger-box plug
---------------------	---------------------

Term. 4 and term. 2

Set value: infinity  $\Omega$ .

Eliminate short circuit to ground.

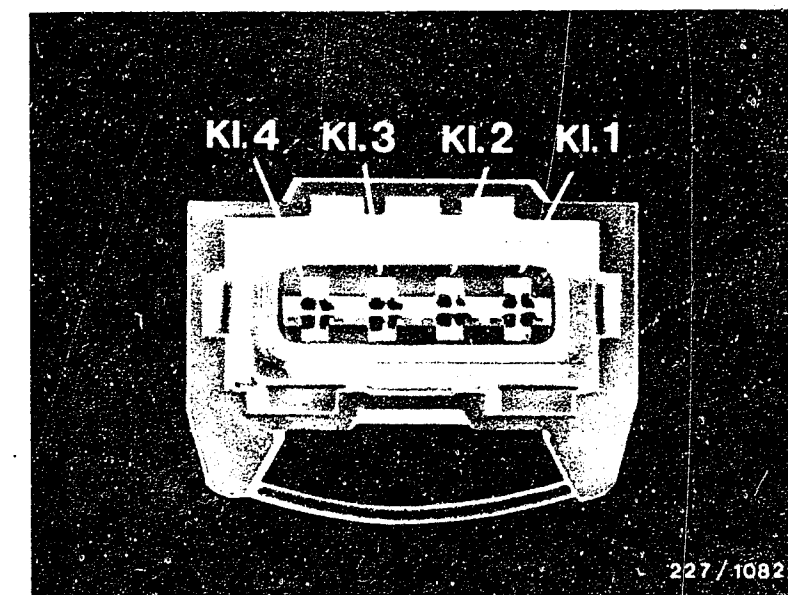
Trigger-box plug	EI control- unit
---------------------	---------------------

Term. 4 and term. 13

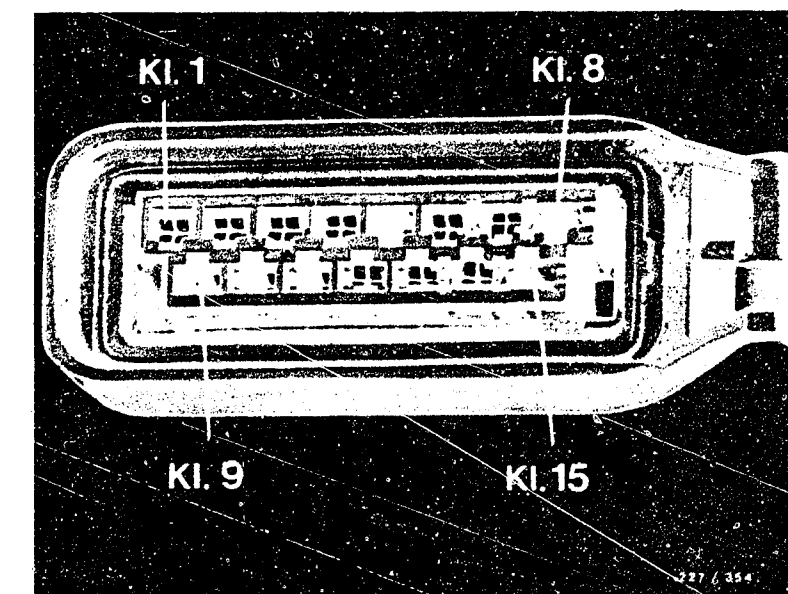
Set value: approx. 0  $\Omega$   
(continuity)

Eliminate open circuit.

If there was no short circuit  
to ground/open circuit, replace  
EI control unit.



Trigger-box plug



EI control-unit plug

Return to trouble-shooting chart  
B03

TROUBLE-SHOOTING PROGRAM ( 9 )

↓

Check primary signal.

EI control-unit plug and  
trigger-box plug connected.

Primary signal with oscilloscope

Connect oscilloscope to ignition  
coil term. 15 (+) and term. 1 (-)  
according to operating instructions.

Start engine.

Oscilloscope must indicate a  
primary voltage (of any  
value).  
See picture.

O R

Primary signal with tachometer

Connect tachometer to  
ignition coil term. 15 (+)  
and term. 1 (-) according to  
operating instructions.

Start engine.

Tachometer must indicate  
a value (any value).

Primary signal present?

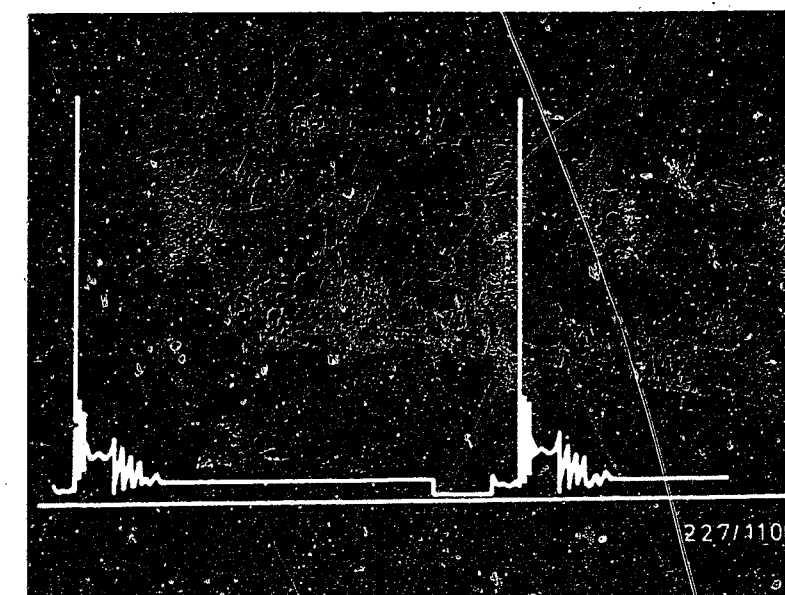
↓

↓

Return to trouble-shooting chart  
B03

N>

Replace ignition coil with  
trigger box.



Primary signal

# TROUBLE-SHOOTING PROGRAM (10)

Check contact resistance  
(primary side).

Disconnect negative and positive  
leads from battery.

Disconnect trigger-box plug.  
See picture.

Switch on ignition.

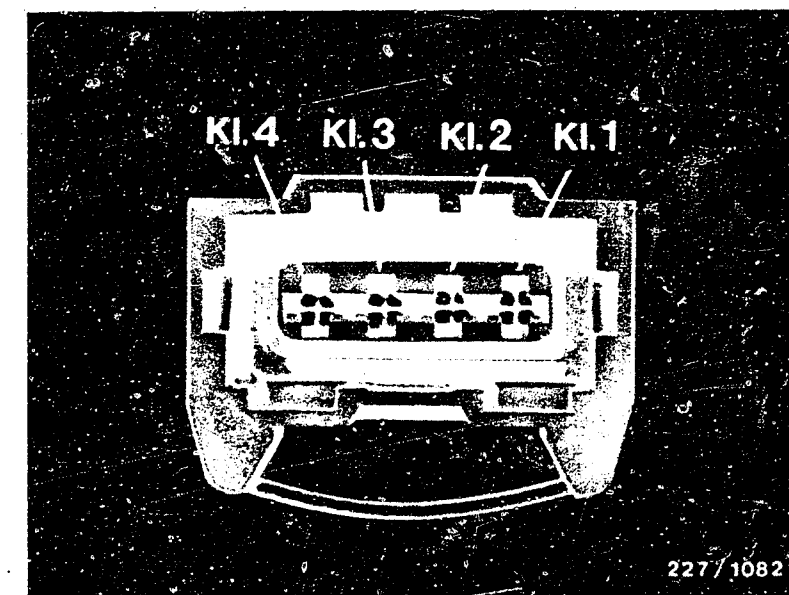
Check for contact resistance  
in leads between positive  
battery terminal and trigger-  
box plug term. 3 including  
leads between negative battery  
terminal and trigger-box plug  
term. 2.

(Take resistance of test lead/  
test prods into account.)

Set value: see brief instructions

Set value obtained?

Eliminate contact resistance.



Trigger-box plug

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM (11)

## TEST APPLYING ONLY TO FUEL-INJECTION ENGINE

Check engine-speed signal.

Disconnect LE-Jetronic control-unit plug.  
See top picture.

Connect oscilloscope according to operating instructions with program switch in "special" position.

For example MOT 201:

Connect red clamp to LE-Jetronic control-unit plug term. 1 (measured signal).  
See top picture.

Connect black clamp to vehicle ground.

Start engine.

Oscilloscope must indicate a rectangular pulse.

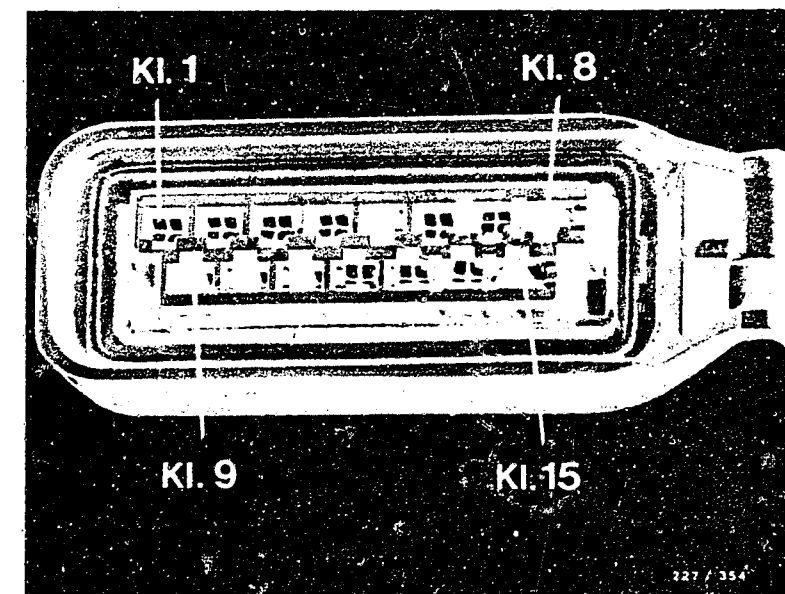
See bottom picture.

Rectangular pulse present?

N>

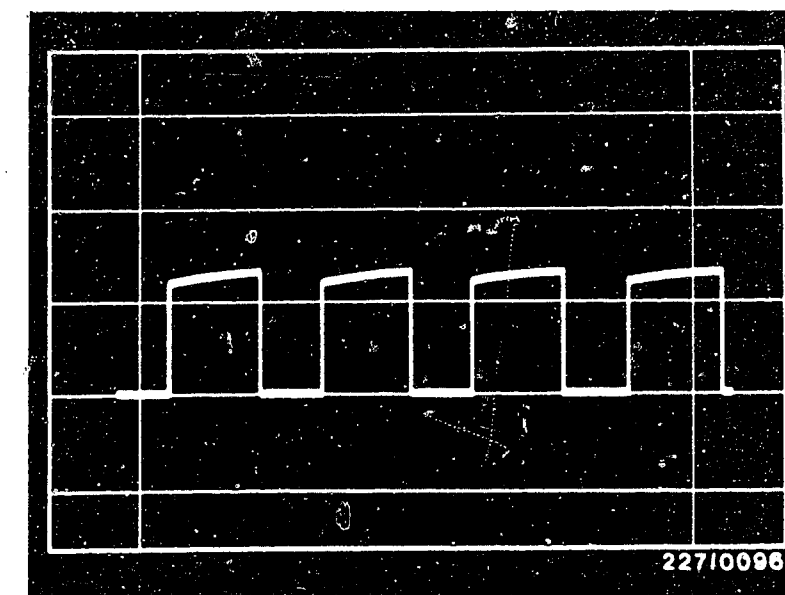
Check for open circuit in lead between EI control-unit plug term. 5 and LE-Jetronic control-unit plug term. 1.  
See top picture.

Eliminate open circuit.



LE-Jetronic control-unit plug

Rectangular pulse



Return to trouble-shooting chart B03

C01

<=>

C02

<=>

## TROUBLE-SHOOTING PROGRAM (12)

V

### TEST APPLYING ONLY TO CARBURETOR ENGINE

Check operation of pressure sensor.

Connect motortester with TDC pickup according to operating instructions.

Disconnect vacuum hose from EI control unit.  
See top picture, arrow.

Operate engine at approx.  
2000 min<sup>-1</sup>.

Read off spark-advance angle.

Connect vacuum hose to EI control unit.

There must be a noticeable change in the spark-advance angle (towards "advance").

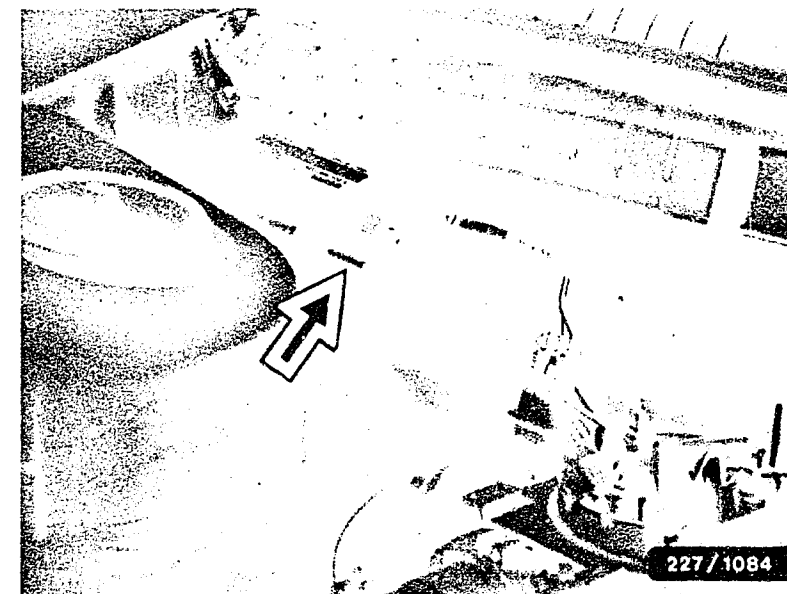
Change in spark-advance angle?

N>

Check for leaks in vacuum hose between EI control unit and carburetor connector (bottom picture, arrow).

Eliminate leaks.

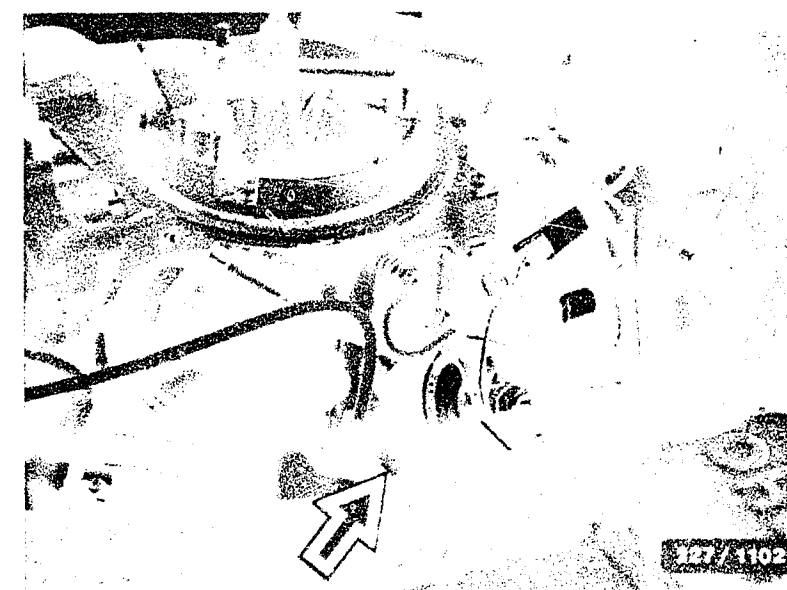
If there was no leak, replace EI control unit.



Arrow = Vacuum hose

Y

Return to trouble-shooting chart B03



Arrow = Vacuum hose

# TROUBLE-SHOOTING PROGRAM (13)

## TEST APPLYING ONLY TO CARBURETOR ENGINE

Check pressure sensor for leaks.

Disconnect vacuum hose from EI  
control unit. See top picture, arrow.

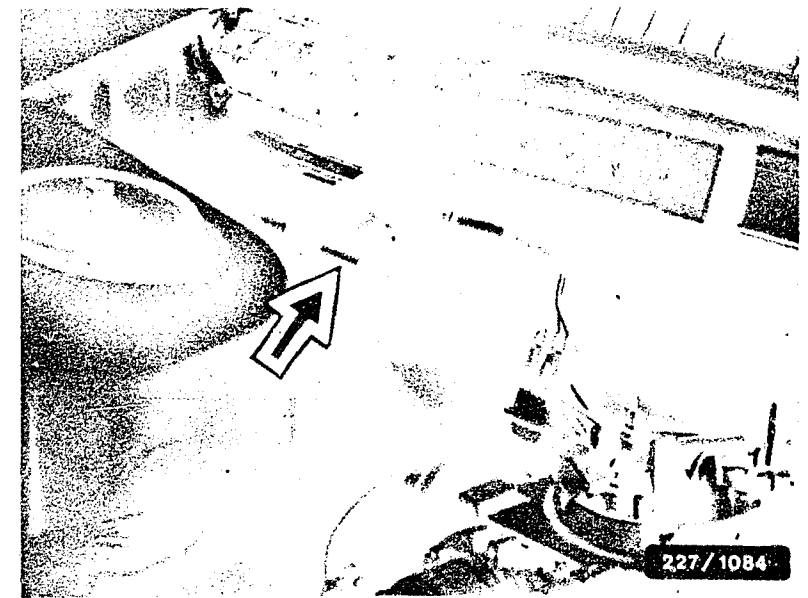
Connect vacuum pump to fitting  
on EI control unit and  
build up vacuum of approx.  
600 mbar.

There must be no noticeable  
drop in built-up vacuum.

Vacuum drop O.K.?

N>

Replace EI control unit.



Arrow = Vacuum hose

Return to trouble-shooting chart  
B03



# TROUBLE-SHOOTING PROGRAM (14)

## TEST APPLYING ONLY TO FUEL-INJECTION ENGINE

Check idle throttle-valve switch.

Disconnect LE-Jetronic control-unit plug.  
See top picture.

Disconnect EI control-unit plug and connect ohmmeter to term. 6 and term. 1.  
See top picture.

Throttle valve in idle position.

Set value: approx. 0  $\Omega$   
(continuity)

Open throttle valve 1...2°.

Set value: infinity  $\Omega$

Set value obtained?

N>

1. Disconnect throttle-valve switch plug.

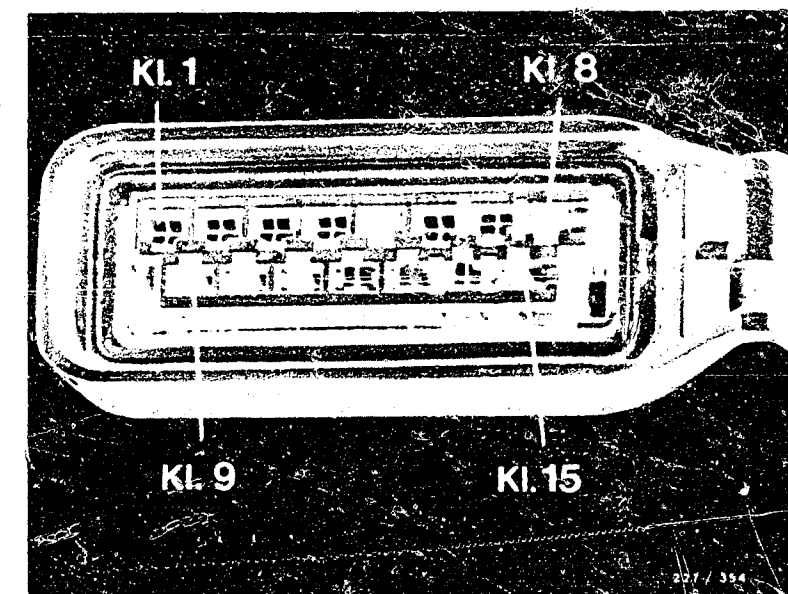
Connect ohmmeter consecutively to:

Throttle-valve switch plug (bottom picture)	EI control-unit plug (top picture)
--	---------------------------------------

Term. 2	and	term. 6
Term. 18	and	term. 1

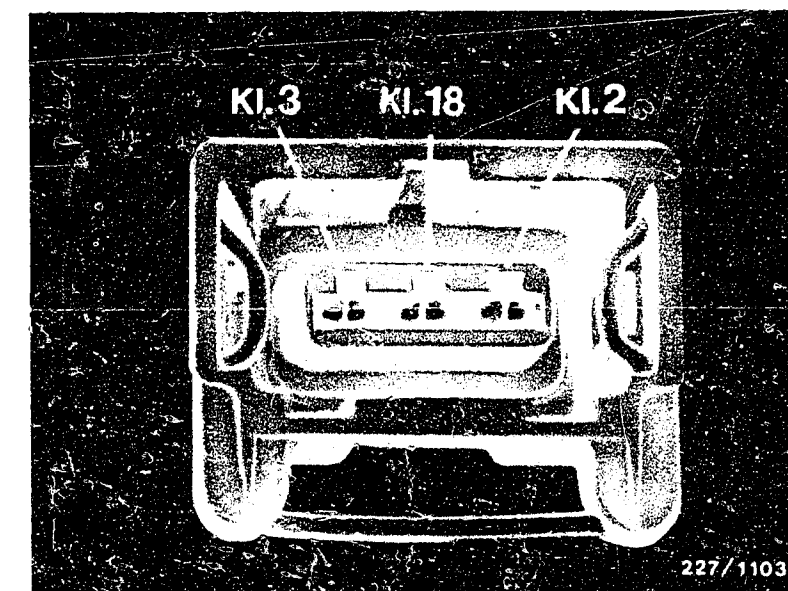
Set value: approx. 0  $\Omega$  in each case  
(continuity)

Eliminate open circuit.



EI-/LE-Jetronic control-unit plug

Throttle-valve switch plug



Return to trouble-shooting chart B03

Continued on next picture page

2. Connect ohmmeter to  
throttle-valve switch term. 2  
and term. 18.

Throttle valve closed.

Set value: approx. 0  $\Omega$   
(continuity)

Open throttle valve approx. 1...2°.  
Set value: infinity  $\Omega$

If set value not obtained,  
adjust throttle-valve  
switch.

P r o c e d u r e :  
Loosen fastening screws of throttle-  
valve switch somewhat and turn  
throttle-valve switch until idle  
contact switches.

Set value: approx. 0  $\Omega$   
(continuity)

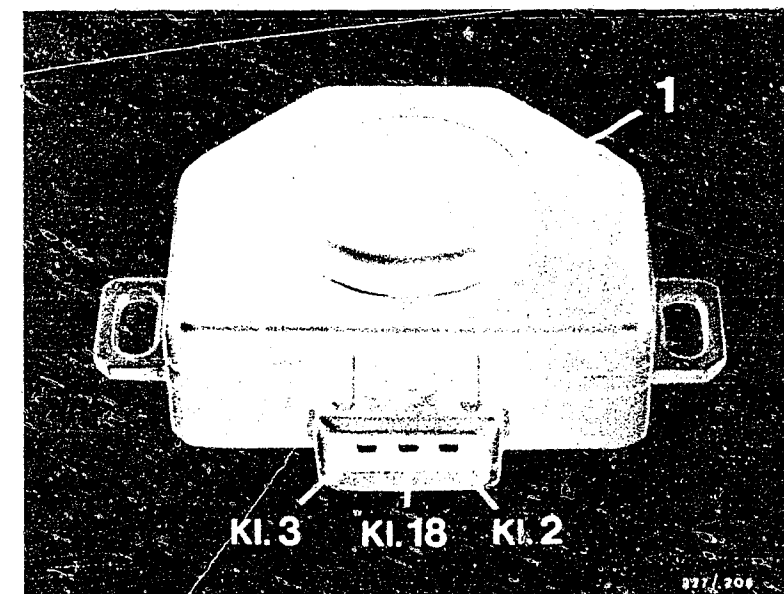
If set value not obtained,  
replace throttle-valve  
switch.

Tighten fastening screws  
of throttle-valve switch.

C h e c k :  
Open throttle valve approx. 1...2°

Set value: infinity  $\Omega$

Return to trouble-shooting chart  
B03



Throttle-valve switch

# TROUBLE-SHOOTING PROGRAM (15)

## TEST APPLYING ONLY TO FUEL-INJECTION ENGINE

Check full-load throttle-valve switch.

Disconnect LE-Jetronic control-unit plug.  
See top picture.

Disconnect EI control-unit plug and connect ohmmeter to term. 14 and term. 1.  
See top picture.

Press accelerator to full-load position.

Set value: approx. 0  $\Omega$   
(continuity)

Release accelerator (idle position).

Set value: infinity  $\Omega$

Set value obtained?

N>

1. Disconnect throttle-valve switch plug.

Connect ohmmeter to:

Throttle-valve switch plug (bottom picture)	EI control-unit plug (top picture)
--	---------------------------------------

Term. 3 and Term. 14

Set value: approx. 0  $\Omega$   
(continuity)

Eliminate open circuit.

2. Connect ohmmeter to throttle-valve switch term. 3 and term. 18.

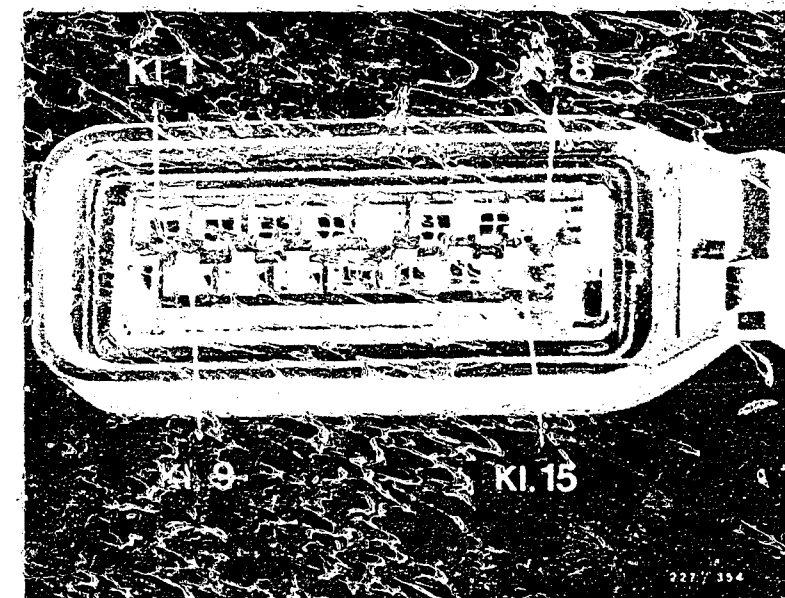
Press accelerator to full-load position.

Set value: approx. 0  $\Omega$   
(continuity)

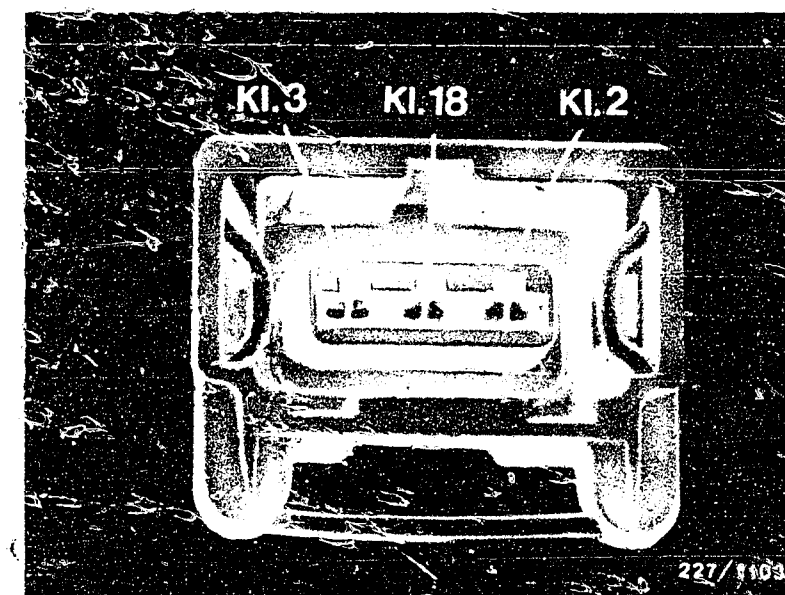
Release accelerator  
(idle position)

Set value: infinity  $\Omega$

If set value not obtained,  
replace throttle-valve switch.



EI-/LE-Jetronic control-unit plug



Throttle-valve switch plug

Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM (16)

Check engine-temperature sensor.

Disconnect EI control-unit plug and connect ohmmeter to term. 7 and term. 2.  
See top picture.

Set value: see brief instructions

Set value obtained?

N>

1. If ohmmeter shows infinity  $\Omega$ , disconnect temperature-sensor plug.  
See bottom picture.

Connect ohmmeter consecutively to:

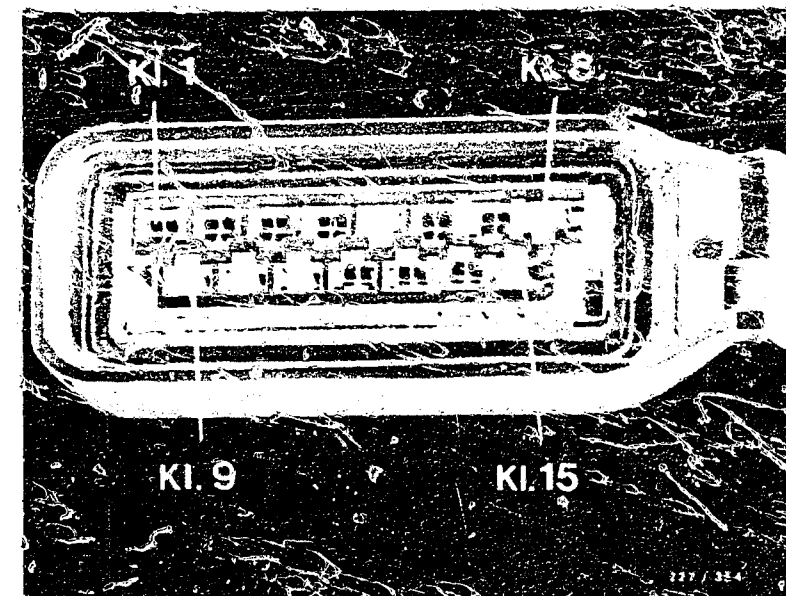
Temperature-sensor plug	EI control-unit plug
Term. 7	and term. 7
Term. 2	and term. 2

Term. 7 and term. 7  
Term. 2 and term. 2

Set value: approx. 0  $\Omega$  in each case (continuity)

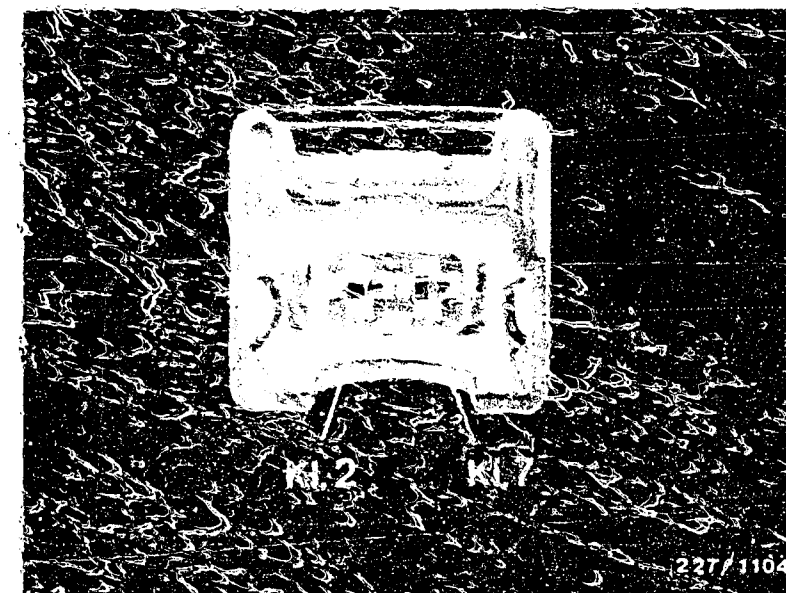
Eliminate open circuit.

2. If set value is different, replace engine-temperature sensor.



EI control-unit plug

Temperature-sensor plug



Return to trouble-shooting chart 803

TROUBLE-SHOOTING PROGRAM (17)

TEST APPLYING ONLY TO FUEL-INJECTION  
ENGINE

Check load signal.

Disconnect EI control-unit  
plug and push back handle  
cover after unscrewing  
fastening screw and taking  
off rubber gasket.  
See top picture.

Connect EI control-unit  
plug.

Connect oscilloscope according to operating instructions with program switch in "special" position.

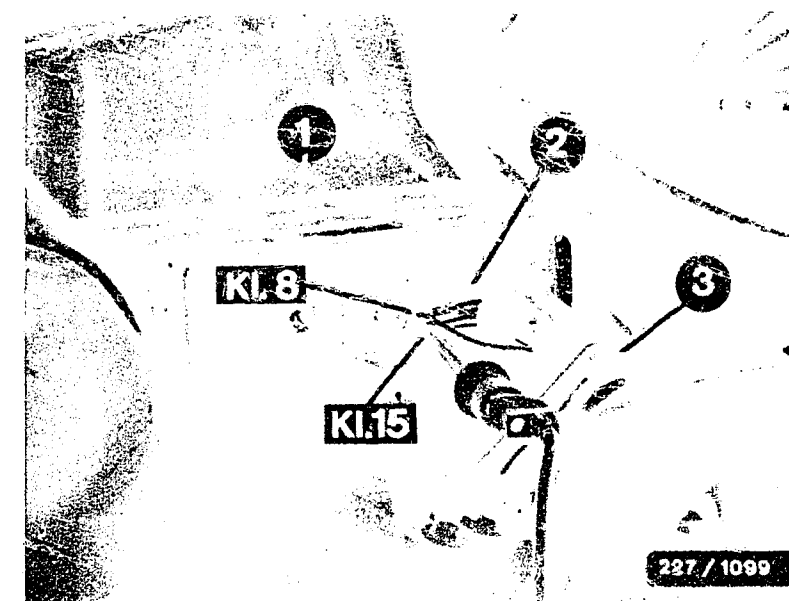
For example MOT 201:

Connect red clamp to EI  
control-unit plug term. 15  
(measured signal).  
See top picture.

Connect black clamp to vehicle ground.

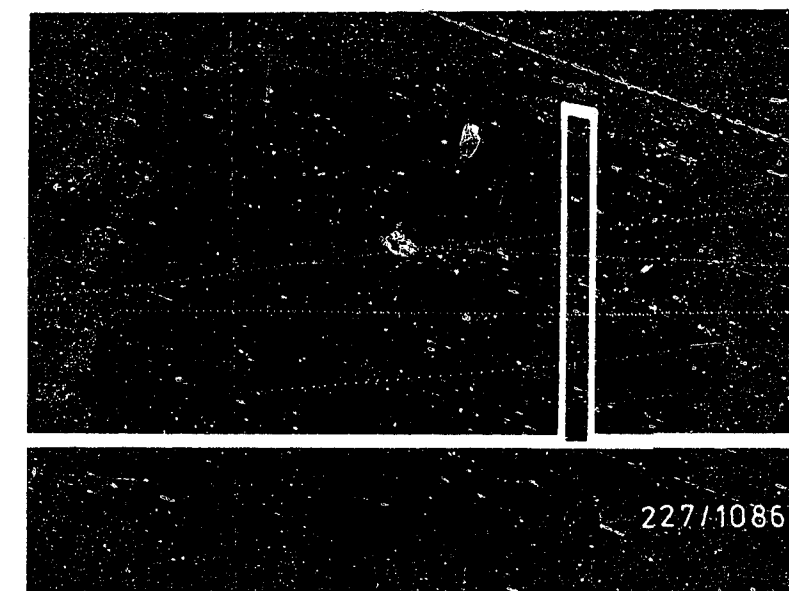
Operate engine at idle.

Load signal must be present.  
See bottom picture.



- 1 = EI control unit  
2 = Plug  
3 = Handle cover

Load signal



Continued on next picture page

# TRUBLE-SHOOTING PROGRAM (17) CONTINUED ( 1 )

Briefly accelerate engine with wide open throttle and observe load signal.

There must be a noticeable change in pulse duration.  
See top picture, arrows.

Change in pulse duration?

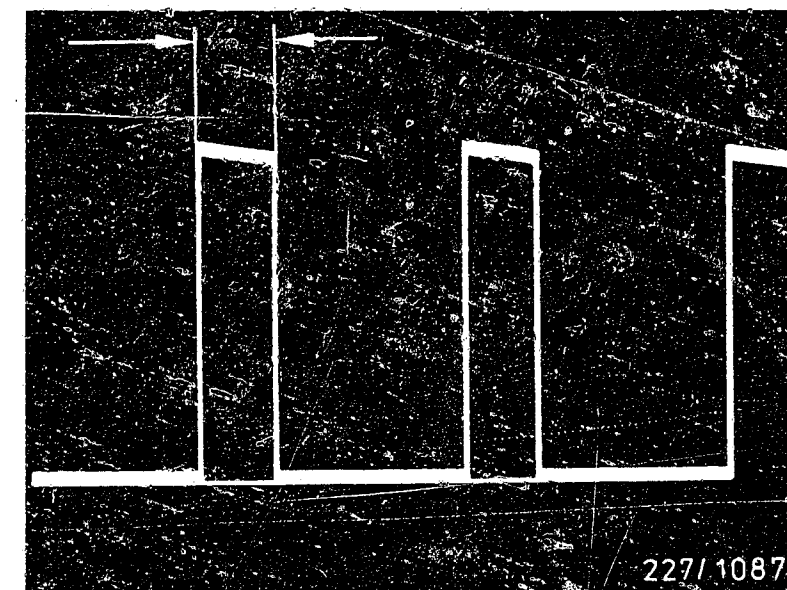
N>

Disconnect EI and LE-Jetronic control-unit plugs.  
See bottom picture.

Check for open circuit and short circuit to ground in lead between EI control-unit plug term. 15 and LE-Jetronic control-unit plug term. 10.

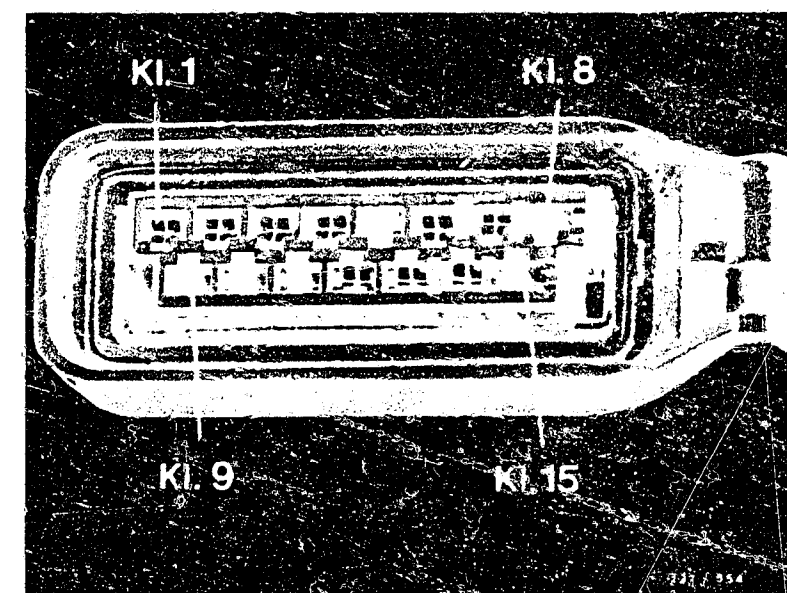
Eliminate open circuit/short circuit to ground.

If there was no open circuit/short circuit to ground, replace LE-Jetronic control unit.



Load signal

EI-/LE-Jetronic control-unit plug



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM (18)

V

Check voltage to ignition coil.

Connect voltmeter to ignition coil term. 15 (+) and negative battery terminal.

Operate engine at idle.

Set value: equal to/greater than 10 V.

Set value obtained?

N>

Disconnect positive lead from battery.

Switch on ignition.

Check for contact resistance in leads between positive battery terminal via trigger-box plug term. 3 and ignition coil term. 15.

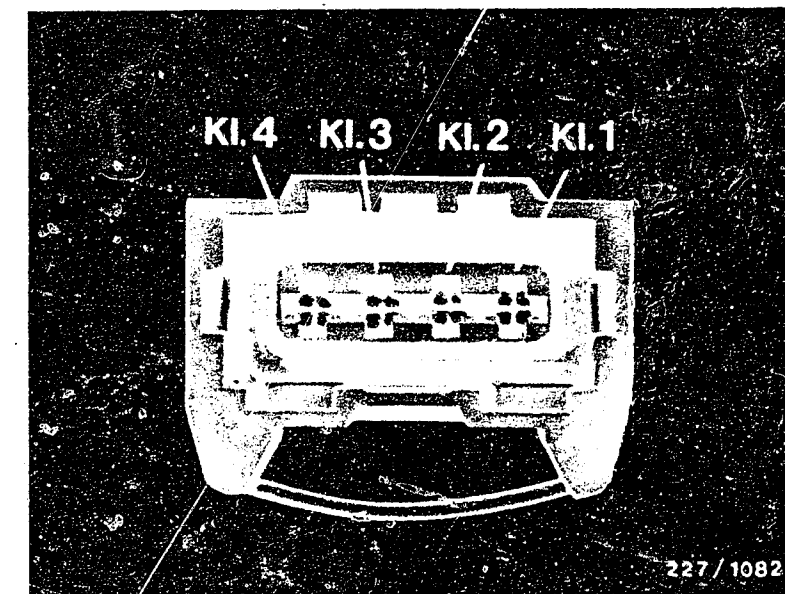
(Take resistance of test lead/ test prods into account.)

Set value: max. 0.5  $\Omega$

Eliminate contact resistance.

V

Return to trouble-shooting chart B03



Trigger-box plug



# TROUBLE-SHOOTING PROGRAM (19)

Check octane-number adjustment.

Disconnect EI control-unit  
plug and connect ohmmeter to  
term. 8 and term. 10.  
See top picture.

Set value: see brief instructions.

Set value obtained?

N>

1. Disconnect encoding plug.  
See center picture.

Connect ohmmeter consecutively  
to:

EI control- unit plug	Encoding plug bottom picture
Term. 8 and	term. 8
Term. 10 and	term. 10

Term. 8 and term. 8  
Term. 10 and term. 10

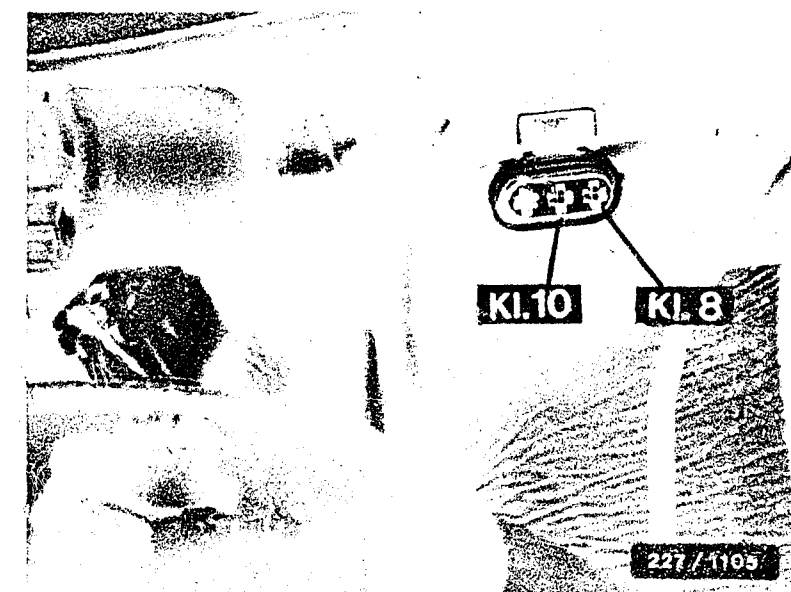
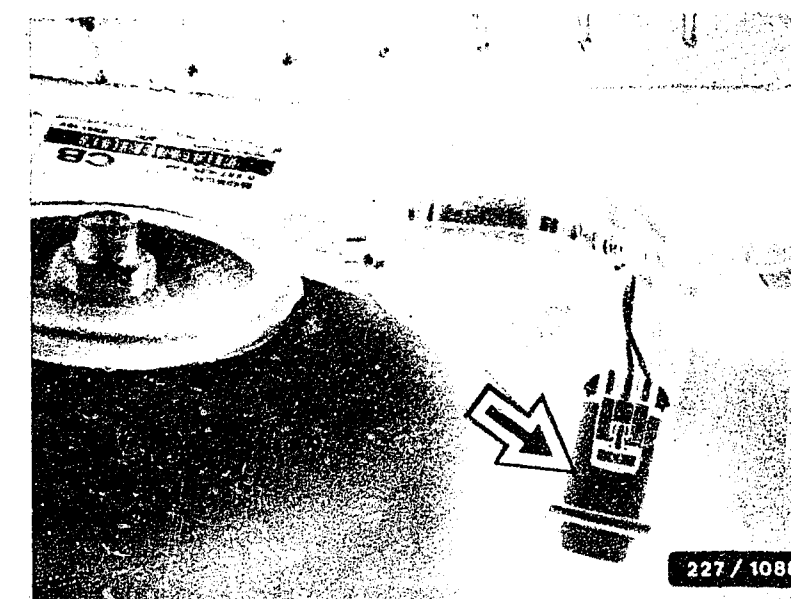
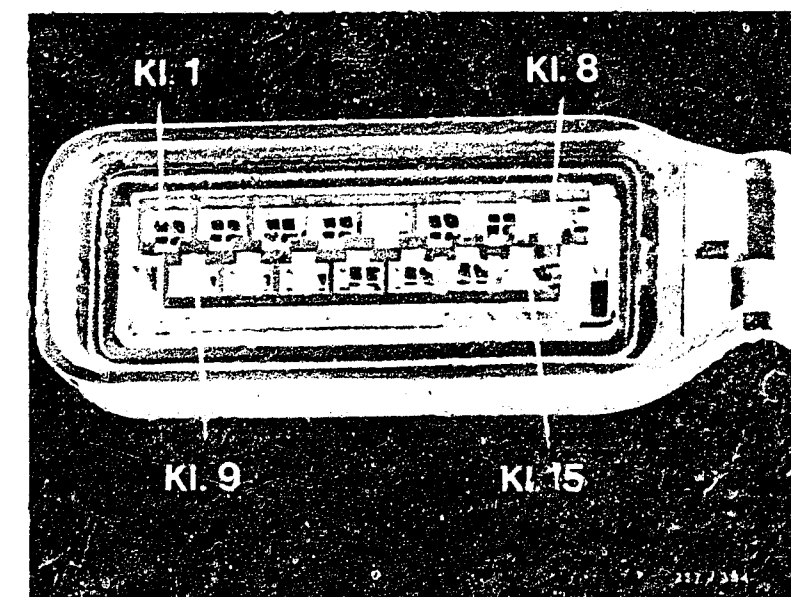
Set value: approx. 0  $\Omega$  in each case  
(continuity).

Eliminate open circuit.

2. Check encoding plug for set  
value.

Set value: see brief instructions

If set value different, replace  
encoding plug.



Return to trouble-shooting chart  
B03



# TECHNICAL BULLETIN

## DANGER OF ACCIDENT ON SEMI- CONDUCTOR IGNITION SYSTEMS

|22|  
VDT-I-227/102 En  
03.1981

Supersedes Feb. 3, 1976 edition

Please be sure to pass this bulletin together with VDE 0104/7.67 enclosed on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufacturers starting to equip their vehicles with semi-conductor ignition systems as original equipment.

In most cases, the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" components or terminals (whether on the primary side or the secondary side) can prove fatal.

In this connection, we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems, the ignition is to be switched off.

Included in such work are the following operations:

- \* Connection of engine testing equipment (timing strobe, dwell-tach tester, ignition oscilloscope etc.)
- \* Replacement of ignition system components (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.)

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor, for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at the individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnosis connector), on terminals, and on test equipment.

In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- \* Operation of the trigger box without the ignition transformer.
- \* At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the dangerous locations being marked with high-voltage arrows.

We would point out that all semi-conductor ignition systems, even the older versions, are to be regarded as dangerous in the sense as defined by this bulletin.

## EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En  
01.1981

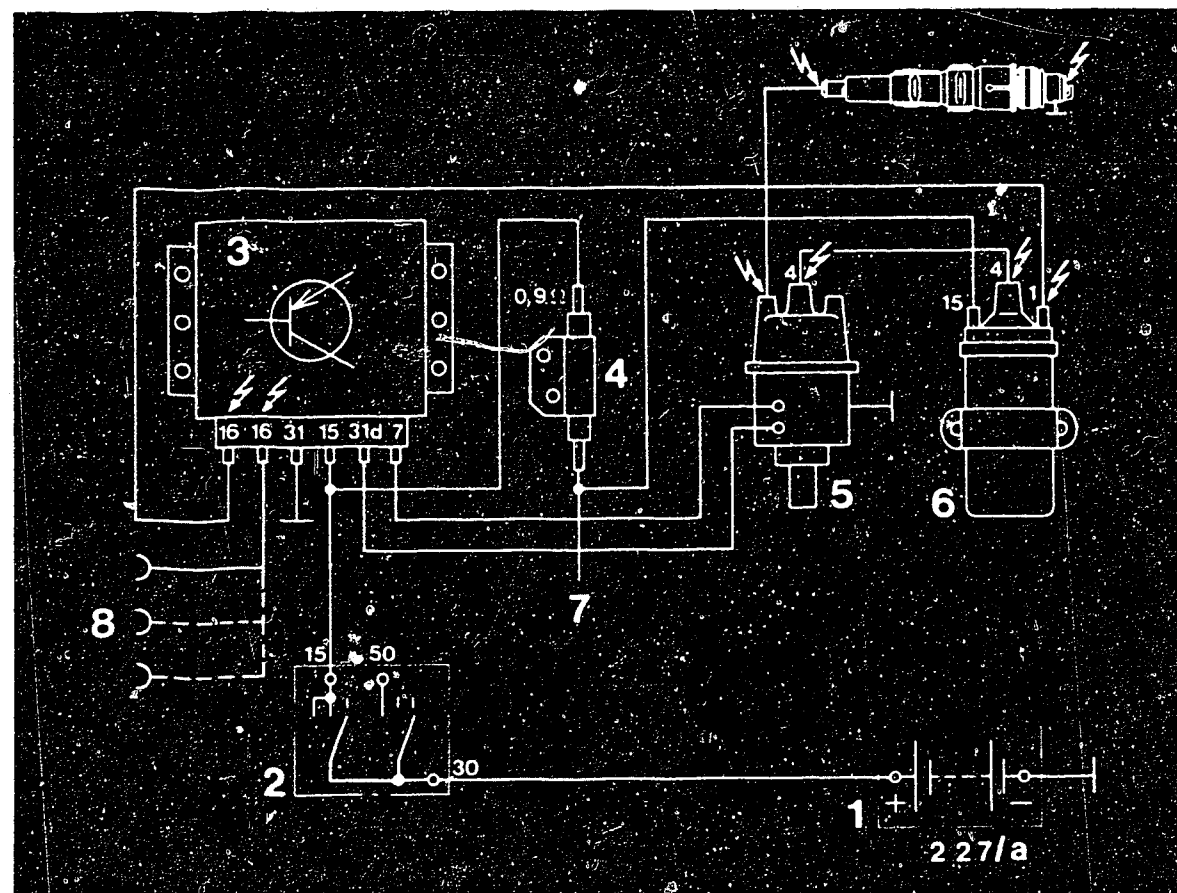
e.g. Ignition systems, Jetronic, Motronic, ABS

Please ensure that this Bulletin is passed  
on to your employees for their attention.

We have often been asked by some of our  
customers whether or not patients with heart  
pacemakers are endangered in any way by  
ignition systems. This theme was recently  
the subject of an examination carried out by  
the Ignition System Development Department of  
Robert Bosch GmbH in conjunction with Dr.  
Thull, lecturer at the Central Institute for  
Biomedical Technology at the University of  
Erlangen-Nürnberg and Biotronic GmbH & Co.  
of Berlin, a manufacturer of heart pacemakers.  
The magazine "Biomedizinischen Technik"  
(5/80) published the results.

The most important discoveries in this practice  
can be summarized from the examination report  
as follows:

1. Heart pacemakers corresponding to the  
latest state of the art are not affected  
by radiation (electromagnetic fields) from  
ignition systems.
2. With a stationary engine and the ignition  
switched off, the heart pacemaker is not  
affected by any part of the ignition system,  
even when unintentionally touched. Main-  
tenance work in the engine compartment, for  
example, can then be carried out without  
any danger.



- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = to starting motor term. 15a
- 8 = to tachometer connection  
or diagnostic plug  
or TD terminal

Published by:

Robert Bosch GmbH  
Division KH  
After-Sales Service Department for  
Training and Technology (KH/VSK)

Please direct questions and comments  
concerning the contents to our authorized  
representative in your country.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers, please introduce the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

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NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En  
01.1983  
Supersedes 5.1981 edition

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Coil ignition	ZS (CI)		Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I * (TCI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
	TSZ-H (TCI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Transistorized ignition	TZ-I * (TI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H * (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Breakerless semi conductor ignition with or without knock control	EZ (EI) (EZ-K) (EI-k)	K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributor-less ignition with or without knock control	VZ (FEI) VZ-K (FEI-k)	K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

\* Note:

The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

## MOTOR VEHICLE SERVICE INFORMATION

INCORRECT DISPLAY OF ROTATIONAL SPEED AND DWELL ANGLE ONLY WITH TRIGGER BOXES 0 227 100 .. (TCI-l, TCI-h) WITH CURRENT LIMITATION

VDT-I-Gen. 030 En  
02.1981

Supersedes ed. 6.1980

For additional information, see VDT-I Gen. 032 En

### 1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00	Rotational-speed	KTE 001.00
001.01	display O.K. with	001.02
001.02	these testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan	(Hitachi ignition system)
Fiat	(Delco ignition system)	Datsun	(Bosch ignition system)
Ford	(Delco ignition system)	Peugeot	(Bosch/Fairchild ignition system)
General Motors	(HEI ignition system)	VW	(Bosch transistorized ignition system for retrofitting)

0 227 100 920

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## 2. Test instructions

### 2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from  $2400 \text{ min}^{-1}$  to  $1200 \text{ min}^{-1}$ ).

It is, however, possible to attain correct rotational-speed measurements:

Connect a ballast resistor of 0.9 or 1.0 Ohms (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

### Suggestion for user manufacture

#### Required parts:

1 ballast resistor 0.9 Ohms      Part no. 0 227 900 002

or

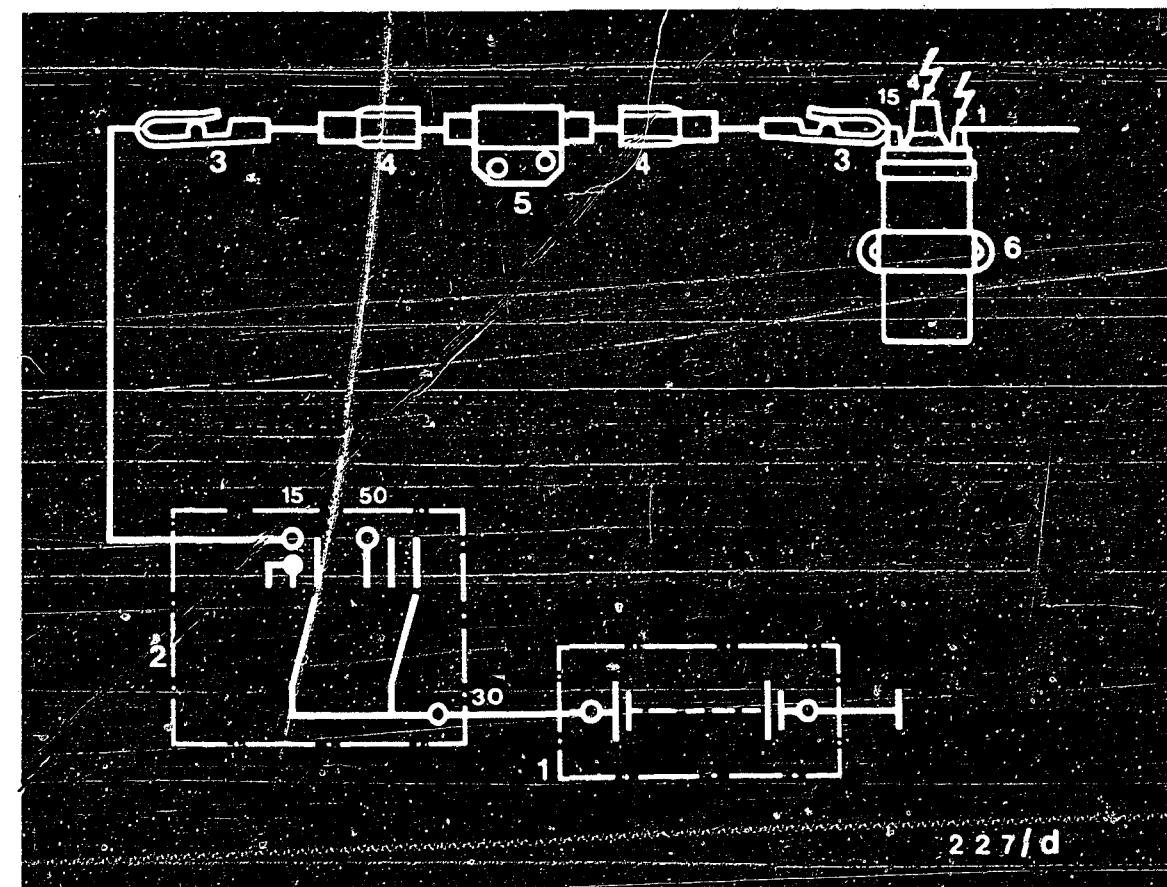
1 ballast resistor 1.0 Ohms      Part no. 0 227 900 101

2 blade receptacles      Part no. 1 901 355 881

e.g. approx. 0.2 m cable,  
1.5 mm <sup>2</sup> e.g.

Part no. 6 210 150 150

2 insulated clips      Commercially available



- |                              |                      |
|------------------------------|----------------------|
| 1 = Battery                  | 4 = Blade receptacle |
| 2 = Ignition/starting switch | 5 = Series resistor  |
| 3 = Terminals                | 6 = Ignition coil    |

Danger arrows: Warning: 400 V...25 KV

### 2.2 Dwell angle

The dwell angle is electronically controlled.  
The dwell angle is no longer measured.

### 2.3 Ignition timing

Is correctly indicated. Tester connections according to operating instructions.

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Robert Bosch GmbH

Division KH

After-Sales Service Department for  
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representative in your country.

## MOTOR-VEHICLE SERVICE INFORMATION

### MOTORTESTER CONVERSION

VDT-I-Gen. 032 En

Incorrect indication of engine speed,  
dwell angle and ignition point  
only with trigger boxes  
0 227 100 .. (TCI-I, TCI-H) with current limitation

06.1980

For additional information see

VDT-I-Gen. 030 of 06.1980

Concerns: Motortester EFAW 268

268 S 10

269

214 B

AE 2000

#### 1. General

Please arrange for above-quoted motor-testers in your workshop as well as at your customers (e.g. motor-vehicle workshops, petroleum companies, gas stations, vocational schools etc.) to be converted. Conversion is subject to payment and is performed by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with installation of switch).

#### 2. Why convert motortesters?

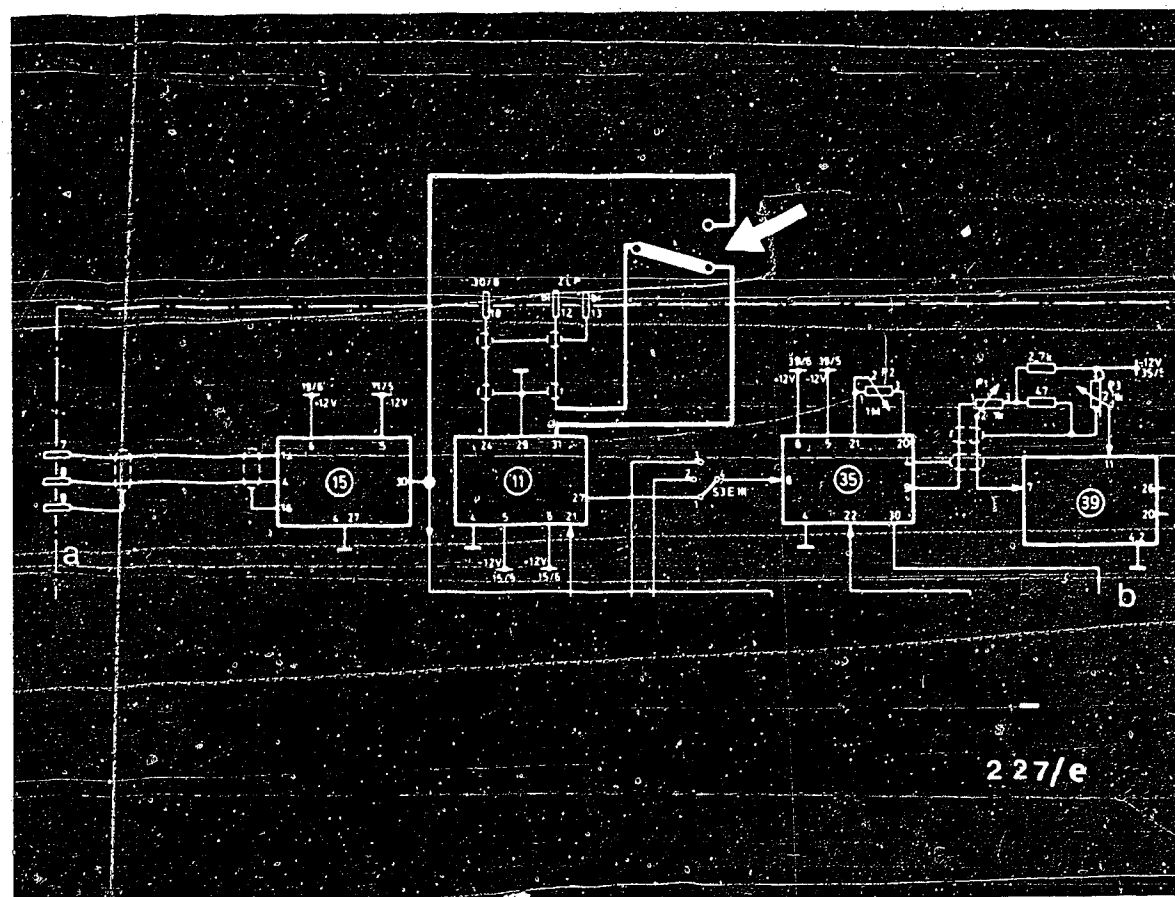
Transistorized ignition systems with current limitation have a different primary-voltage characteristic from conventional ignition systems. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values between 1.5 V and battery voltage (or greater), which, when checking the ignition system, may lead to an incorrect indication of engine speed and dwell angle and to incorrect triggering of the counter.

There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing strobe is triggered by the signal-path dwell-angle meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

#### 3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing strobe is triggered by the clamp-on induction pickup and the pulse shaper stage.





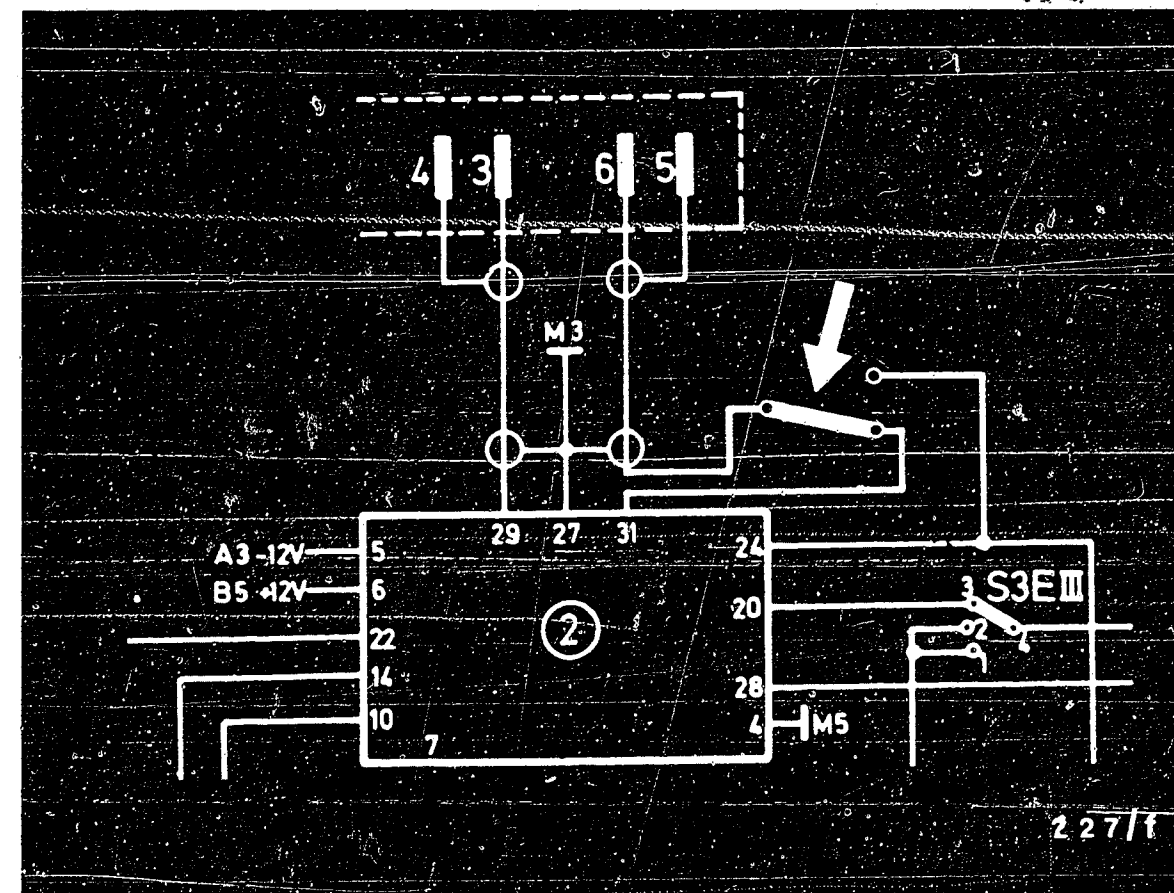
a = Clamp-on induction pickup  
b = (Extract from WJF 508/1, Page 53)

EFAW 268, 268 S 10, 269, AE 2000

Remove the line of the ZLP from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.



(Extract from WJF 503/1, Page 64))

EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.



By fitting the switch with change-over contact in the front panel of the motortester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly:  
e.g. "Standard" - "Current limitation".  
These conversion measures have already been published in the K7 information sheet KJF 28/7911.

#### 4. Test instructions

##### 4.1 Standard ignition systems

Switch position: "Standard".

All other tester connections as per operating instructions.

##### 4.2 Ignition systems with current limitation

Switch position: "Current limitation".

In order to trigger the timing strobe, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

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## MOTOR VEHICLE SERVICE INFORMATION

### TESTS ON ELECTRONIC IGNITION SYSTEMS (TCI, TI) TESTER INSTRUCTIONS

VDT-I-Gen. 035 En  
03.1981

The following tests are listed in older and current Tester operating instructions or in "Trouble-shooting with the oscilloscope":

- \* "Separate ignition coil test"  
(Concerns EFAW 213, 214, 268, AE 2000)
- \* Calculating the "ignition voltage reserve"  
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- \* "Intensified insulation test"  
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays, transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7 Information K7-VJF 17/8012.

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# MOTOR VEHICLE SERVICE INFORMATION

OPEL ENGINES WITH CATALYTIC CONVERTERS

VDT-I-OPE-028 En  
06.1986

BOSCH SUPER SPARK PLUGS

For engines with catalytic converters Opel has released BOSCH SPARK PLUGS which are also used in original equipment.

1.8 l engine WR 6 DC 0 242 240 511  
3.0 l engine WR 7 BC 0 242 235 522

Irrespective of this, BOSCH SPARK PLUGS may be installed in other engines - including Opel engines - which are listed in the BOSCH spark-plug chart, irrespective of whether they have already been approved for use by the engine manufacturer or not.

In this case, the general remark of many engine manufacturers applies, namely that the installation of officially non-approved spark plugs is also permissible if they comply in their technical specification with the approved spark plugs.

BOSCH undertakes the full guarantee for this in accordance with the known warranty.

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ROBERT BOSCH GMBH  
Division KH  
Technical After-Sales Service (KH/VKD 2)

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For production reasons:  
continued on the following  
coordinate.

For production reasons:  
continued on the following  
coordinate.

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IMPRESSUM

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